Royal Commission
on Canada's Economic Prospects

Housing and Social Capital

by Yves Dubé, J. E. Howes and D. L. McQueen

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ROYAL COMMISSION ON CANADA'S ECONOMIC PROSPECTS

HOUSING AND SOCIAL CAPITAL

by

YVES DUBÉ, J. E. HOWES and D. L. McQUEEN

JANUARY, 1957

While authorizing the publication of this study, which has been prepared at their request, the Commissioners do not necessarily accept responsibility for all the statements or opinions that may be found in it.

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PREFACE

THE AUTHORS of this study are indebted to a large number of people whom they had occasion to consult on general problems relating to housing and social capital, and on such specialized matters as schools, highways, waterworks and hospitals.

Officials of all three levels of government—federal, provincial, and municipal—gave generously of time, advice and information. Particular mention should be made of the Department of National Health and Welfare (Research and Statistics Division and Public Health Engineering Division), and of the Dominion Bureau of Statistics (Census Division, Education Division, General Assignments Division, and Public Finance and Transportation Division).

The Central Mortgage and Housing Corporation also deserves special thanks. Material prepared in the Corporation's Economic Research Department forms the basis and indeed much of the superstructure of the chapter on housing.

Officials of universities and of sundry non-governmental organizations gave invaluable help. The Canadian Good Roads Association, the Automotive Safety Foundation (Washington, D.C.), and the Canadian Transit Association may be mentioned. Most useful analyses of urban servicing costs were provided by Imperial Oil, Limited (with respect to the towns of Devon and Redwater, Alta.), and by two development firms in the Toronto area.

Full responsibility for text and statistics rests, needless to say, with the authors.

A final word of thanks is in order to Miss M. J. Kinsella for her help in revising the study and putting it into its final form. Mrs. G. Morgan of the Royal Commission staff and Mr. Ross Wilson also rendered numerous services.

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INTRODUCTION

Subject of the Study

If there is anything which chiefly characterizes a modern industrial economy, it is the possession of a large stock of capital assets—of houses, factories, warehouses, office buildings, dams, machinery and other facilities designed not to be consumed but to be a means, together with labour, of producing goods and services.[1] The importance of such a stock to the achievement of a high standard of living is well enough illustrated by the eagerness with which so-called under-developed countries seek to increase the amount and variety of their capital equipment. Different endowments of natural resources have of course a most significant bearing on differences in national wealth, but natural resources without the capital equipment to exploit them are only potential riches, and by and large countries with high standards of living are also countries with relatively large stocks of capital equipment per head.

A capital asset may be approximately defined as something durable which helps to produce something else.[2] The something else may be goods or services; if it is goods, it may be consumption goods, or it may be another capital asset such as a machine tool or a pile-driver. It may be something which is sold, such as a refrigerator or a dry-cleaning service; or it may be something which is not sold. A church is a capital asset just as much as a factory: its "output" is, in strictly economic terms, a certain kind of service.

For the purposes of the Royal Commission's work, capital assets have been divided into industrial capital, housing and social capital. The present study is concerned with the last two categories. Housing is self-explanatory. Social capital is taken to include schools and universities, churches and related buildings, hospitals, roads and streets, airports, sewer and water sys-

[1] Inventories of goods stored up for later sale are also capital assets, but are not dealt with here.

[2] "Durable facilities used in producing, transporting, selling and servicing other types of goods and services". (*Private and Public Investment in Canada, 1926-1951*, p. 9, Department of Trade and Commerce.) An exception is made for a class of commodities which includes such things as domestic stoves and refrigerators and private automobiles. These are called "durable consumer goods".

tems, and other buildings and installations appertaining to public institutions and departments of government.

Distinction Between Industrial and Social Capital

It has to be admitted that the above delimitation of social capital has been made partly with a view to statistical convenience. There are, nevertheless, some important respects in which most of the assets named differ from those which have been put by implication into the industrial category. The *Oxford Concise Dictionary* defines an industry as "a branch of trade or manufacture". In Canada, at any rate, the word "industry", when it is not being used to designate a personal quality, generally suggests an expectation of profit; and it is a reasonable presumption that the great majority of those assets which would here be called industrial are brought into being with the hope of making money—for a person or group of persons, for an incorporated company, or for a government-owned business enterprise.

Schools, universities, churches and hospitals, by contrast, are not usually built with an eye to profit. Fees may be charged in some cases, but rarely are they intended to cover the full cost of operation and capital charges. Some kinds of roads, notably provincial highways, may be charged for in the sense that part or all of the cost of building and maintaining them is recovered from motorists by way of gasoline taxes and motor vehicle licence fees, but the return is not direct, nor is it always in proportion to the service rendered.

One cannot say, however, that all of what is here called social capital is distinguished by a lack of regard for profit: there are exceptions. Toll roads and bridges exist. Many town and city water systems are organized as self-supporting utilities, meeting their expenses out of user rates.

Perhaps it helps to clarify the nature of social capital somewhat if one inquires into its relationship to industrial capital and to industrial activity. Looked at from this standpoint, social capital would seem to play a facilitating role. While not itself industrial, it helps to make industry possible. Without roads, trade and commerce would be paralyzed; without schools, there would be no skilled industrial labour force. It is not through motives of benevolence alone that when large industrial enterprises move into remote or under-developed areas, they often undertake, on their own initiative, to provide a complement of social capital. Under modern conditions, the existence of a large aggregation of industrial capital without a social counterpart somewhere in the vicinity would be all but inconceivable.

Thus, when people want money spent on social capital, they will as often as not attempt to justify the outlay on the grounds of usefulness to industry. University spokesmen, for example, may suggest that a timely industrial donation now will yield good dividends of scientists, engineers and executives in the future.

But one of the most significant characteristics of social capital is that much of it does not require this kind of justification at all. Hospitals would still be built, even if it could be proved conclusively that they did not contribute a single extra revolution per minute to the wheels of industry. The main reasons for erecting churches, or community rinks, or concert halls, have even less to do with facilitating industrial production.

Indeed, one might argue that it is the industrial component of capital which is ancillary to the social, rather than the other way round. Industry and industrial organization are, after all, primarily a means to an end. But social capital and its associated institutions are both this and more. They relate, in part, to what is meant by civilization in the highest sense; they are worth having in themselves; they justify industry even as they facilitate it.

Would it be possible to say, then, that social capital consists of assets to which society attaches a special value quite apart from any apparent usefulness to industry? Unfortunately, one would be hard put to explain just why roads and airports should be accorded a species of accolade which is denied to railways. Perhaps a better definition is this: that social capital consists of assets for which society as a whole, through the medium of governments and other public institutions, desires to assume a direct and continuing responsibility. The expression is still far from precise; to what extent it really covers all the different kinds of assets discussed herein, the reader must judge.

The Case of Housing

Housing falls rather between the industrial and the social categories and for that reason is considered separately. Some housing is a direct responsibility of governments and is built by governments; most however is not. At the same time, the public has clearly come to expect governments to assume *some* measure of responsibility for all housing, be the responsibility only indirect. A house is not just another capital asset: it carries connotations of home and family; it has a special value in the eyes of society.

Advantages of the Division

If the foregoing argument has done its work, the division of capital into housing, social, and industrial components should now seem not wholly illogical. Economists familiar with the more usual distinction between "public" and "private" capital may ask, however, what advantage there is in the breakdown used.

Perhaps the main thing that can be said for it is that it focuses attention on the nature of the particular asset or investment, rather than on the agency which carries out the expenditure. Whether an investment is made by a government or by a non-governmental institution or other organization (practice often varies from province to province), or whether it is made by one level of

government rather than by another, ceases to matter. The important thing is whether the asset involved is one for which society as a whole would wish to assume a peculiar responsibility. Sometimes, assets of this character tend to be a little forgotten merely because they do not happen to be an immediate concern of government.

Housing and Social Capital Expenditure in the Economy

The main purpose of the study is to look into the future with a view to determining what may have to be spent on housing and social capital in Canada over the next 25 years. Before the plan of attack is outlined, however, some attention should be given to what has been spent in the past.

Gross new investment in housing and social capital in 1955 is estimated to have been of the order of $2.8 billion, or 10.6% of Gross National Expenditure. Not only the absolute amount, but the percentage share, was probably a twentieth-century record. Over the 30 years 1926-55 inclusive, housing and social capital investment as a proportion of national expenditure averaged about 7.1%. This figure is much influenced by the high housing and social capital expenditure of the last few years: the median for the period was only 6.8%.

Examination of the first part of Table 1 will show that in fact there has been considerable fluctuation in the afore-mentioned percentage. In 1930, housing and social capital investment accounted for 8.4% of national expenditure. This dropped to 4.9% in the deep depression year of 1933, recovered in the late '30's, then fell back again during the Second World War. After the close of hostilities there was a pronounced rise, interrupted only by the Korean War, until by 1955 the country was devoting 5.6% of its total outlay to housing and another 5% to social capital.

Despite the fact that some social capital expenditure, notably on water and sewer systems, tends to be influenced by housing growth, the fluctuations in the two categories have not always coincided. In the early part of the Second World War, total expenditure on social capital was inflated by large outlays on barracks, hangars and other military installations; whereas expenditure on housing, though higher than it had been in the late '30's, did not increase as fast as Gross National Expenditure and actually declined from 1941 to 1943. Since Korea, expenditure on housing has increased a good deal more rapidly than expenditure on social capital.

It is of interest to note that expenditure on housing and social capital combined has not bulked as large in the economy as expenditure on industrial capital. The latter accounted for an estimated 12.9% of Gross National Expenditure in 1955, compared with 10.6% spent on the other two. Average percentages over the period 1926-55 were 9.7 and 7.1 respectively.

GROSS NEW HOUSING AND SOCIAL CAPITAL INVESTMENT IN CANADA, 1926-56

Part I

(in millions of current dollars)

Year	Housing	Social capital		Total	Gross National Expenditure	Housing and social capital expenditure as a percentage of Gross National Expenditure		
		Construction	Machinery and equipment			Housing	Social capital	Total
1926	212	110	17	339	5,294	4.0	2.4	6.4
1927	217	139	21	377	5,647	3.8	2.8	6.7
1928	236	157	24	417	6,105	3.9	3.0	6.8
1929	247	184	28	459	6,166	4.0	3.4	7.4
1930	204	228	33	465	5,546	3.7	4.7	8.4
1931	168	188	27	383	4,560	3.7	4.7	8.4
1932	96	125	19	240	3,767	2.5	3.8	6.4
1933	76	83	14	173	3,552	2.1	2.7	4.9
1934	98	103	15	216	4,034	2.4	2.9	5.4
1935	114	117	19	249	4,345	2.6	3.1	5.7
1936	139	113	20	272	4,701	3.0	2.8	5.8
1937	176	169	26	370	5,355	3.3	3.6	6.9
1938	159	155	27	341	5,233	3.0	3.5	6.5
1939	185	150	29	364	5,707	3.2	3.1	6.4
1940	200	201	67	468	6,872	2.9	3.9	6.8
1941	244	320	148	712	8,517	2.9	5.5	8.4
1942	224	362	142	728	10,539	2.1	4.8	6.9
1943	204	335	149	688	11,183	1.8	4.3	6.2
1944	237	204	71	512	11,954	2.0	2.3	4.3
1945	286	190	65	541	11,850	2.4	2.2	4.6

Table 1 Part I (Continued)

1946	412	253	54	719	12,026	3.4	2.6	6.0
1947	540	330	60	930	13,768	3.9	2.8	6.8
1948	668	466	87	1,221	15,613	4.3	3.5	7.8
1949	776	541	73	1,390	16,462	4.7	3.7	8.4
1950	846	601	79	1,526	18,203	4.6	3.7	8.4
1951	821	763	97	1,681	21,474	3.8	4.0	7.8
1952	826	1,041	125	1,992	23,255	3.6	5.0	8.6
1953	1,084	1,046	125	2,254	24,473	4.4	4.8	9.2
1954	1,178	1,058	119	2,355	24,317	4.8	4.8	9.7
1955p	1,496	1,224	108	2,828	26,769	5.6	5.0	10.6
1956e	1,574	1,407	116	3,096	—	—	—	—

p "Preliminary actual" expenditure.
e Beginning of the year estimates.

SOURCES: Housing and social capital expenditure:
(a) Housing and Other Construction:
1926-49 inclusive—*Private and Public Investment in Canada 1926-51*, Department of Trade and Commerce.
1950—*Private and Public Investment in Canada: Outlook*, 1952, Department of Trade and Commerce.
1951-56 inclusive—*Construction in Canada* (annual), Dominion Bureau of Statistics.
(b) Machinery and Equipment:
1926-49 inclusive—*Private and Public Investment in Canada 1926-51*, Department of Trade and Commerce.
1950-56 inclusive—*Private and Public Investment in Canada: Outlook* (annual), Department of Trade and Commerce.
Gross National Product:
1926-49—*National Accounts, Income and Expenditure 1926-1950*, Dominion Bureau of Statistics.
1950-55—*National Accounts, Income and Expenditure 1950-1955*, Dominion Bureau of Statistics.

GROSS NEW HOUSING AND SOCIAL CAPITAL INVESTMENT IN CANADA, 1926-56

Part II

(in millions of constant 1949 dollars)

Year	Housing	Social capital		Total	Population (thousands)	Housing and social capital expenditure per capita (constant dollars)		
		Construction	Machinery and equipment			Housing	Social capital	Total
1926	442	183	27	652	9,451	47	22	69
1927	450	230	35	715	9,637	47	27	74
1928	478	256	39	773	9,835	49	30	79
1929	479	290	45	814	10,029	48	33	81
1930	406	374	56	836	10,208	40	42	82
1931	358	334	47	739	10,376	35	37	71
1932	223	232	34	489	10,510	21	25	47
1933	189	159	24	372	10,633	18	17	35
1934	230	194	28	452	10,741	21	21	42
1935	269	217	33	519	10,845	25	23	48
1936	320	203	35	558	10,950	29	22	51
1937	377	283	42	702	11,045	34	29	64
1938	349	265	45	659	11,152	31	28	59
1939	403	258	47	708	11,267	36	27	63
1940	408	336	102	846	11,381	36	38	74
1941	448	506	210	1,164	11,507	39	62	101
1942	379	533	195	1,107	11,654	33	62	95
1943	320	467	196	983	11,795	27	56	83
1944	352	283	95	730	11,946	29	32	61
1945	415	263	89	767	12,072	34	29	64

Table 1 Part II (Continued)

1946	559	330	72	961	12,292	45	33	78
1947	658	387	71	1,116	12,551	52	36	89
1948	710	484	92	1,286	12,823	55	45	100
1949	776	541	73	1,390	13,447	58	46	103
1950	802	568	75	1,445	13,712	58	47	105
1951	683	642	82	1,407	14,009	49	52	100
1952	667	819	106	1,592	14,430	46	64	110
1953	850	789	104	1,743	14,781	58	60	118
1954	919	797	98	1,814	15,195	60	59	119
1955p	1,137	892	87	2,116	15 601	73	63	136

p Current dollar figures which were deflated were "preliminary actual" expenditure.

SOURCES:

(a) For the source of housing and social capital expenditure in current dollars see Part I of this table.

(b) The Dominion Bureau of Statistics national accounts implicit price deflators for gross domestic investment (1935-39 = 100) were converted to the base 1949 = 100 for use in calculating constant dollar figures.

Much of the increase that has occurred in the annual rate of housing and social capital expenditure since 1926 can of course be attributed to rising prices. The real increase seems nevertheless to have been substantial. In the second part of Table 1, expenditure in the two fields is expressed in constant dollars, then divided by figures of population. If the averages for the periods 1926-30 and 1951-55 are compared, real housing expenditure per head shows an increase of 24%, and real social capital expenditure per head a rise of 94%.

These increases would probably have been less had it not been for the making good of backlogs accumulated during years of war and depression. All the same, there are strong reasons for suspecting, even in the absence of long-period statistics of capital stock, that over the last, say 60 years, the physical inventory of social capital must have risen a good deal faster than population.[3] Increasing real wealth is bound to affect people's opinion of what constitutes a proper complement of social capital: as a country's income grows, what could not be afforded yesterday becomes indispensable today.

But changes in ways of life and patterns of social organization, not to mention technical and scientific advancement, also play an important part. Thus if there were fewer miles of water main in 1896 than in 1956, it was not merely that the population was smaller and poorer, but also that a larger proportion of it lived in places where a public water supply was something less than a necessity. If there were fewer secondary schools, it was partly that there were fewer 14-year-olds, of whom a larger proportion had to work on the family farm or otherwise earn their own living; but partly also that the desirability of a secondary education seemed nowhere near as pressing in the economy of the day. There was a time when babies were born at home; now we insist on the hospital. The rise of the automobile has transformed out of recognition the idea of what constitutes a good road.[4] Standards have changed; desires have shaded into necessities; and the minimum acceptable baggage of community equipment per head of population has grown. To disentangle greater ability to pay from the other forces which have brought about this alteration of view would doubtless require a very subtle psychological analysis indeed. The fact remains that the expansion of social capital has been a function, not only of growing numbers and wealth, but also of the increasing complexity and sophistication of Canadian life.

Urbanization and Social Capital

When one reviews some of the likely reasons why the per capita need for particular kinds of social capital has increased over the last half century

[3]So far as housing is concerned, the ratio of persons to dwellings is estimated to have fallen from 5.6 in 1881 to 4.1 in 1955 (Firestone, O. J., *Residential Real Estate in Canada, 1949*, p. 197 and *Housing and Urban Growth in Canada, 1956*, p. 9, Central Mortgage and Housing Corporation).

[4]One of the authors of this study can recall that as late as 1919 a proposal to pave what is now the portion of Bay Street extending from Queen Street to College Street in Toronto was condemned as extravagant.

or so, one is impressed by how many of them seem to be associated in one way or another with the rise of cities and towns. Sewer and water systems are peculiarly urban phenomena; so for the most part are concert halls, juvenile courts, technical colleges, and six-lane bridges. Farmers, too, need roads, schools, and other facilities; and they need them more than they used to. But it has been in the cities and their surrounding areas, gathering to themselves an ever-larger proportion of the total population, that the stock of social capital has most tended to proliferate. It has been from city-dwellers that the demand has most characteristically arisen for the resolution of traffic congestion, the training of children for an ever-wider variety of industrial, commercial and professional occupations, and the satisfaction of multifarious recreational needs. It has been, by and large, in the thickly populated, highly urbanized regions of Southern Ontario and Quebec and the lower mainland of British Columbia that the problem of water pollution has become most general and most pressing.

But the interaction of urbanization and social capital requirements does not end there. The modern city is a most persistent and effective propagandist for its own way of life. Through press, radio and television, it imbues the rural resident with a desire for urban standards of comfort and service, not least in such matters as medical care, schooling and recreation. One response to such stimuli is, of course, to move to the city; another is to travel to the city more often and obtain more services there. Still another is to demand that the quality and availability of certain rural and small-town facilities be brought up to, or nearer to, city levels. Whatever the case, the result is an increase in social capital—more and better rural hospitals, for example, or the expansion of city hospitals to accommodate more rural or formerly rural patients. On social capital as on many other things, urban and rural outlooks have drawn closer together.

Experience would thus suggest that urbanization is likely to have an important bearing on future social capital requirements. Chapter 2 is accordingly devoted to this matter.

Housing and Social Capital Expenditure Since 1951

Statistics are available which show housing and social capital expenditure since 1951 in some detail. Table 2 indicates that over the period 1951-55, housing accounted for just under half the total new investment in housing and social capital. Roads and streets, accounting for about a seventh of the total, were the next largest item, followed by "other buildings", schools and universities, and hospitals, in that order.

GROSS NEW HOUSING AND SOCIAL CAPITAL INVESTMENT IN CANADA, 1951-56 Table 2

1. *New Construction Expenditure* *(millions of current dollars)*

Sector	Housing	Government and institutional sectors									Utilities sector (part)	Total new construction expenditure
Type of structure		Schools and other educational buildings	Hospitals, sanitoria, clinics, etc.	Churches and other religious buildings	Roads, highways, streets, etc.	Aerodromes, hangars, landing fields, etc.	Sewage systems and drains, etc.	Water-works	Other buildings	Other construction	Water-works	
Code Nos.[a]	1	14	16	15	32-36 incl., 63, 64, 69.	20, 37	38, 40	39	2, 6, 8, 9, 10, 11, 12, 13, 17, 18, 19, 22, 23, 24	25, 26, 27, 28, 29, 31, 43, 45, 46, 47, 48, 49, 51, 65, 66, 67, 70	39, 41, 42	
1951....	821.0	105.6	65.5	28.3	259.1	15.5	37.2	2.5	178.4	49.0	22.0	1,584.1
1952....	826.0	135.0	79.5	25.2	334.0	45.0	55.0	8.6	253.0	69.8	35.4	1,866.5
1953....	1,083.7	137.9	108.5	27.1	292.8	59.1	57.1	6.5	207.4	107.8	41.6	2,129.5
1954....	1,178.0	155.4	109.5	32.3	321.5	15.1	86.3	7.2	209.6	70.4	50.5	2,235.8
1955p...	1,495.7	201.5	132.7	35.3	384.0	15.4	88.5	9.4	233.4	75.6	48.5	2,720.0
1956e...	1,573.5	220.5	131.5	45.4	473.7	17.2	94.5	10.2	272.7	77.2	63.7	2,980.1

2. *New Investment in Machinery and Equipment*

	Housing	Government and institutional sectors					Utilities sector (part)	Total new investment in machinery and equipment
Type of structure		Schools and universities	Hospitals	Churches	Other institutions	Government departments	Water-works	
1951....	—	12.6	13.5	3.8	—	60.1	6.8	96.8
1952....	—	19.3	11.9	1.8	—	88.2	4.0	125.2
1953....	—	14.7	15.2	2.9	.2	86.8	4.7	124.5
1954....	—	22.2	15.2	3.2	.2	76.1	2.4	119.3
1955p...	—	20.6	14.5	3.1	.8	67.0	1.5	107.5
1956e...	—	22.5	19.1	3.3	.4	68.1	2.2	115.6

3. *Total Housing and Social Capital Expenditure*

	Total new construction and machinery and equipment expenditure
1951.....	1,680.9
1952.....	1,991.7
1953.....	2,254.0
1954.....	2,355.1
1955p.....	2,827.5
1956e.....	3,095.7

NOTES: Figures for new construction as given in *Construction in Canada* do not exactly agree in all years with figures given in *Private and Public Investment in Canada*. Final revisions account for the differences.

a Code numbers refer to *Construction in Canada 1954-1956*.

p "Preliminary actual" expenditures.

e Beginning of the year estimates.

SOURCES: New construction expenditure—*Construction in Canada* (annual), Dominion Bureau of Statistics.
New investment in machinery and equipment—*Private and Public Investment in Canada: Outlook* (annual), Department of Trade and Commerce.

Forecasting Methods

There are various ways in which gross new housing and social capital investment in Canada over the next 25 years could conceivably be predicted. One way would be to forecast savings (in the national accounts sense), then to make assumptions as to how these savings might reasonably be allocated to industrial capital, housing and social capital. Another would be to project, in the light of the expected growth in population and income, what has been spent on housing and social capital in the past.

There are two great difficulties with any projection based on past expenditure. The first is that information on social capital investment prior to 1951 is not available in much detail. The second is that for the last 25 years, spending on housing and social capital has been carried out under a succession of extraordinary circumstances. First there was the depression, then the Second World War, then the effort to make good the resulting backlogs and at the same time keep pace with rapid population growth in a situation of cold war and heavy defence expenditure. The last period that might reasonably be called normal was possibly 1926-30, and as has been mentioned, standards in many fields have changed markedly since then. What was spent, for example, on roads in those days would be a dubious guide to the expenditure of 1957, let alone of 1980.

The method or collection of methods actually used is based, as far as possible, on population growth, as forecast in another study for the Royal Commission,[5] and on need. The word "need" is a notoriously slippery customer. Its scope has a way of varying with levels of personal and national income; and indeed, through most of the chapters which follow, the question, *What can we afford?,* will generally be found skulking in the background, disguised under some such expression as "reasonable standard". Nevertheless, an effort is made to shut out considerations of finance and to establish criteria of physical need which, in conjunction with the population forecast and with estimates of average unit costs, can be made to yield dollar figures for new housing and social capital requirements over the next quarter century.

The method appears in its purest form in Chapter 4 on hospitals. A physical standard is established—the average number of hospital beds which, in the opinion of competent persons consulted, should be provided for each 1,000 of population. The number of beds that would be required adequately to serve the expected population of 1980 is then calculated, and the existing "bed-stock" subtracted. The resulting figure is then multiplied by an estimate of the average cost of new hospitals per bed to yield a forecast of investment in hospitals over the 25-year period.[6]

[5] *Output, Labour and Capital in the Canadian Economy.*

[6] A separate calculation is, of course, made for each of the three main kinds of hospital: general, mental and tuberculosis.

Table 3

FORECAST OF POPULATION USED IN THE STUDY

(assuming 75,000 annual net immigration)

Provinces	(thousands of persons) 1955	1965	1970	1975	1980
Atlantic	1,761	2,000	2,120	2,240	2,360
Quebec	4,520	5,780	6,430	7,150	8,010
Ontario	5,183	6,730	7,590	8,540	9,620
Manitoba	849	990	1,060	1,130	1,220
Saskatchewan	889	990	1,040	1,090	1,150
Alberta	1,066	1,310	1,450	1,610	1,770
British Columbia	1,305	1,720	1,950	2,230	2,520
Canada (excluding Yukon and Northwest Territories)	15,573	19,520	21,640	23,990	26,650

SOURCE: *Output, Labour and Capital in the Canadian Economy* (a study prepared for the Royal Commission).

The calculation of housing and elementary school requirements proceeds along somewhat the same lines, except that the population figure used is not the over-all forecast of population but a derivative of it: a forecast of family and non-family households in the case of housing, and a forecast of school-age population in that of schools.

In Chapter 6, which deals with roads and streets, the population-needs method as described has to be abandoned. With respect to road and street expenditure, the great expansionary influence is deemed to be not population growth *per se,* but the growth in motor vehicle registrations. Just what any given increase in vehicle numbers and vehicle travel should imply in terms of outlay on roads and streets is very difficult to judge in the present state of knowledge, and the ultimate forecast is a compromise between the results obtained by three different methods. Two of these methods rest on a forecast of vehicle registrations, which in turn is based on a forecast of gross national production. Only in this instance are calculations related to any specific assumption concerning the future size of the national product.

In the case of miscellaneous government buildings and installations, resort has to be had, for want of a practicable alternative, to the projection of past expenditure.

The above summary of methods is necessarily over-simplified in some respects. Certain additional factors, such as the expected urban-rural distribution of the population, are taken directly into account in some places. The existence of marked regional differences in the amount of social capital per head of population will be well known, at any rate by inference, to students of federal-provincial relations. In some cases, the assumption is made that these regional differences will be lessened or wiped out. It is

assumed, for example, that by 1980, hospital standards, as to both quality and availability of accommodation, will be more even across the country than they are today. But where such differences appear to be a direct consequence of variations in topography and other natural features, it is assumed that they will persist. Allowance for broad physiographic differences, such as the proximity or remoteness of large bodies of water, is made in the calculation of sewer and water needs as well as of other requirements.

Initial calculations cover construction expenditure only. Where the completed asset includes an additional element of machinery and equipment, this is calculated as a percentage addition to construction expenditure. The expression, "machinery and equipment", should not be taken too literally: a home furnace is undoubtedly a piece of machinery, but the statistical practice in Canada is to include it in the construction cost of the house.

Backlog and Replacement

Future gross investment in housing and social capital will take place not only because new needs are arising, but because backlogs of old ones have still to be met, and because assets do not last forever but wear out and must be replaced.

The forecaster who hitches his wagon to a need standard should, by rights, estimate the size of any present backlog and make provision for its removal. This can be done quite readily with respect, for example, to hospitals. The approximate size of the present hospital "bed-stock" is known, and one has only to apply the physical need standard to this and to multiply the apparent deficiency by a unit cost figure in order to arrive at a dollar total for backlog. But the roads backlog which most people would admit to exist cannot be measured in this way.

Where there seems to be a reasonable basis for estimating the size of a backlog in dollars of current construction cost, an equivalent "catching up" allowance is incorporated in the relevant forecast. Where there is no such basis, a specific allowance is not made, but a physical or dollar standard of need is selected which is somewhere in the higher ranges of plausibility.

The presence of backlog should affect not only the over-all size of an expenditure forecast, but its distribution by sub-periods. Treatment in this respect varies. Some backlogs are more tolerable than others. A serious backlog in roads, for example, is probably somewhat easier to live with than one in hospitals or schools. Accordingly, some backlogs are assumed to be made up within ten years, but in other fields a state of perfection is not reached until 1980.

As for replacement, it is assumed (very unrealistically, no doubt, where machinery and equipment are concerned) that none of the new assets put in

place over the next 25 years will wear out during that period. Provision for the replacement of existing assets is made where there is some basis of estimate. Little, unfortunately, is known about the age and life expectancy of the present stock of social capital, and allowance for replacement is consequently incomplete and spotty.

Quality Improvements

The point has been made that standards of social capital provisionment have moved upward over the last half century. Given continued prosperity and economic growth, there is every reason to expect this process to continue. Some of the need standards here utilized may seem a little high in terms of present average practice. Many of them will probably not seem so in 1980.

The extent of future quality improvements is extremely difficult to foresee, and no particular allowance is made for them here so far as social capital is concerned. With respect to housing, it seems safe to assume an improvement in quality great enough to add 7% to the average cost per dwelling unit.

Use of Provincial and Municipal Forecasts

Many provincial and municipal governments and other authorities submitted forecasts of housing and social capital expenditure to the Royal Commission. These estimates were very helpful in the preparation of the present report—more so than may at first appear. Occasionally, the figures could be used as they stood; more often, their coverage was insufficiently broad, or the underlying assumptions (regarding population growth, etc.) on which they were based differed significantly from those made here. (Persons making comparisons between forecasts should keep a sharp eye out for such differences.) But even where figures could not be used, the methods used to derive them often could be; and the various briefs were a particularly fruitful source of need standards and unit cost estimates. They also provided much-needed information concerning certain backlogs.

Housing and Social Capital in the Yukon and Northwest Territories

It will have been observed that the forecast of population on which the study is based specifically excludes the Yukon and Northwest Territories. Information on birth and death rates in the Territories is not as reliable as it is in the rest of Canada, while the population possibilities of the North are peculiarly difficult to forecast.

Federal authorities have estimated future requirements for some kinds of social capital in the Territories. These estimates are added in where appro-

priate. The most notable items for which no forecast is included are housing and schools.

Possible Value of the Study

Strictly speaking, what the study attempts to forecast is not so much what is *likely* to happen—no account is taken of possible political and financial developments—as what *would* happen given a certain growth of population, certain need standards, and no general increase in prices.

The best of forecasts is no more than a system of guesses with pretensions to internal consistency. Be it ever so intricate, the whole structure must rest on treacherous sands of assumption. The preceding discussion of method will have given ample warning of the caution and reserve which should be exercised in interpreting the results.

Essentially, the forecast is a 25-year one for all Canada. Breakdowns by ten- and five-year periods and by provinces are indeed given; but in the majority of cases they are no more than breakdowns and are determined in quite arbitrary fashion. It is felt that in most of the fields covered the whole has, on the average, a slightly better chance of coming true than any of the parts.

The study is of course designed to fit into the larger pattern of Royal Commission investigations. It is hoped that it will prove useful, or at any rate stimulating, in other contexts. An attempt is made to set the scene a little, and to give some idea of the shape, as well as of the dollar magnitude, of the problems which appear to lie ahead.

People with practical experience in, say, education, highway administration, or urban planning, will require little reminding that, in the real world, considerations of public need and financing are likely to get very much entangled with one another. It may well be better this way. Many town planners now maintain that long-term physical and financial planning should march in step, and that an end should be put to the distressing spectacle of beautiful, integrated plans battering their heads against financial limitations. The adoption of a strict physical needs viewpoint in the present report results in a certain air of incompleteness, if not of unreality, hanging over much of the discussion.

Yet there is perhaps something to be said for ignoring finance, and for thinking of housing and social capital purely as a physical apparatus for the facilitation of certain functions. The functions are important ones; there is much about them to discuss; and their nature sometimes becomes a little clearer if the historic clamour of fiscal and constitutional dispute is for a while excluded.

2

URBANIZATION AND ITS IMPLICATIONS

THE POINT has been made that many social capital requirements are typically urban requirements, and that urban growth and the need for social capital are importantly related. Housing, too, should be considered in relation to urban growth. Once a certain increase in the national population is assumed, the degree of urbanization foreseen for the period should not greatly affect the estimate of the number of new housing units required, except in so far as people are expected to abandon still-usable houses in the country and demand accommodation in town. But urban growth has a most significant bearing on the *kind* of housing that is likely to be needed.

It would therefore seem essential, in attempting a forecast of housing and social capital, to make some assumption as to the extent to which the future population of Canada will live in cities and towns, and particularly in large metropolitan and urban areas. That the population will become steadily more urbanized, there seems little doubt: everything in the experience of this and other industrial countries suggests it. What is much more open to argument is the rate, pattern and distribution of urbanization. How much of the net gain in population is likely to accrue to our present 15 census metropolitan areas and how much to smaller cities and towns? How big are our biggest cities likely to become? Broadly speaking, and without implying that the relationship between size and per capita cost is necessarily a smoothly ascending one, one may venture to say that the more the increase in population accrues to the large metropolitan areas, the more expensive it is likely to be to provide the necessary increase in social capital.[1]

A proper answer to the foregoing questions would seem to demand the broadest sort of economic analysis, taking in such things as probable technological developments in transportation and production, probable patterns of resource development, the future availability of water and energy, and so

[1]Considerable attention has been given to the possibility of determining "economic" and "optimum" sizes for cities. The problem is an interesting and complex one. See the *Report of the Royal Commission on the Metropolitan Development of Calgary and Edmonton,* Chapter 5.

forth. It would demand, in other words, the findings of all the other Royal Commission studies, supplemented by a detailed examination of the prospects of every city and urban area in Canada.

Since an undertaking on this scale would be a study in itself and since, in any case, the history of previous thoroughgoing attempts to forecast the populations of individual cities has been almost uniformly discouraging, it has been decided, for the purposes of the present report, to employ a simpler and more arbitrary method. Basically, the method consists in relating the past population growth of the 36 principal urban areas of Canada to the 25-year forecast of the national population. It assumes, in effect, that the forces making for the expansion of large urban areas—the mechanization of agriculture, the attractions of city life, the tendency for industry to concentrate in locations favoured by proximity to some or all of large markets, ample supplies of skilled labour, cheap energy sources and good transportation facilities—will be just as strong in the future, relatively to national population growth, as they have been in the past.

These are very large assumptions, and they are made tentatively, with no desire to prejudge what should by rights be some of the most important economic issues in Canada over the next quarter century. If urban growth is going to be anything like what is forecast, then not only industrial location but the whole process by which urban areas expand and develop should be most keenly studied and analyzed by economists. For this purpose, a much greater development of regional economic statistics will be essential. If some of the more sweeping assumptions of this chapter provoke effort in this and related directions, they will have done good.

Manufacturing and Urban Growth

The question may be asked whether the rate of future urbanization will not be heavily dependent on the *kind* of economic development that takes place—on the extent, for example, to which the emphasis falls on manufacturing as opposed to primary or other types of industry. The association of urban growth with busy factories is of course a familiar and popular one —witness the efforts of small but ambitious towns to secure new manufacturing industry—and there is no gainsaying its validity. The expansion of Hamilton, Windsor, Oshawa and many other centres in the Great Lakes-St. Lawrence region is ample evidence of the connection.

It is nevertheless well to remember that urbanization antedates the modern factory by a good many centuries; and that the historical rise of London, New York, and numerous other metropolises has probably owed far more to their activities as shippers, distributors and financiers than to their manufacturing production. Nor have economies largely based on the export of one or two primary commodities necessarily failed to experience a substantial growth of cities: as early as 1901, the two cities of Sydney and

Melbourne alone contained nearly a million people, more than a quarter of the population of Australia,[2] while in Canada the years 1901-11, coinciding with the great wheat boom and the opening up of the West, were marked by a sharp increase in the percentage of the population classified as urban and as great an addition of population of Montreal, Toronto and Winnipeg as to all the rural areas of Saskatchewan and Alberta combined.[3]

Experience since that time, in the 1920's and again since the Second World War, has thrown into still sharper relief the urban consequences of the expansion of primary industry. Examples are plentiful of developments in the mining and petroleum industries which have had most important stimulating effects on the economy as a whole and thus on a wide range of urban activities, yet have employed relatively few persons on site. The fact would seem to be that under condition of modern technology, even the hewing of wood and drawing of water is increasingly a matter for townsmen; or rather that the active hewers and drawers, who themselves more often live in towns and cities, increasingly tend to be outnumbered by the urban echelons to the rear by the administrators, financiers, suppliers, shippers, and providers of ancillary and personal services. Note may be taken that the two fastest-growing metropolitan areas in Canada between the censuses of 1941 and 1951 were Edmonton and Calgary, both owing much of their expansion to neighbouring resource development, and neither employing as much as a fifth of its labour force in manufacturing at the end of the period.[4]

It may be, therefore, that the question of whether the main forward thrust of the economy in the future is likely to come from manufacturing or from some other sector is not after all so crucial to a forecast of urban growth. It may have a considerable bearing on which urban areas experience the growth. So long, however, as the output-per-man-hour of agriculture continues to increase, and so long as the general level of non-agricultural employment, whatever its industrial distribution, remains high, it is difficult to see how the over-all trend toward towns and cities can be other than strong and pervasive.

Industrial Decentralization

Another objection which may be raised to the assumption that the big urban agglomerations will get bigger at the same rate in relation to national population growth as in the past concerns industrial decentralization.

The location of most industrial plants is, inevitably, a compromise. The ideal location would be one where labour, energy, and raw materials were all cheap, plentiful, and close at hand, and where there was a large, easy-

[2]Woytinsky, W. S. and E. S., *World Population and Production*, p. 122, and *Year Book of the Commonwealth of Australia 1951*, p. 522

[3]"The Trend to Bigger Cities", Bank of Nova Scotia *Monthly Review*, July 1955.

[4]*Ibid.*

to-serve market in the immediate vicinity. In practice, there are few places which can offer all these desiderata together, and the decision of where to locate involves a balancing of considerations, including the highly important one of transportation and transportation costs.

Occasions arise when a single requirement, such as that of electric power in the case of the primary aluminum industry, all but overwhelms every other locational influence. More often, it is a matter of two or three considerations combining to outpull the rest. For many industries, a large urban area which satisfies the labour desideratum, which is itself a major market and is close to other markets, and which is well served by transportation agencies, will seem attractive even if energy is not especially cheap and raw materials have to be brought from a distance. The complexity and interdependence of many industrial processes make, too, for a snowballing effect: certain kinds of plant attract others.

In the early years of the century, when coal was still king, when the transport of raw materials and finished products over roads and streets was a matter of horse-drawn drays, and when the urban labour force came to work on foot or by street car, there were good reasons for industry not only to locate in cities, but to cluster in more or less central parts of cities, close to the confluence of railway lines or on the waterfront.[5]

The advent of electricity and of automobile and truck transport has gone some way to weaken the attraction of central districts. Energy supply, materials, products, and labour force have all become more mobile. It has become possible to locate away from the centre; it has also become positively desirable in some cases. Rising labour costs have encouraged a trend toward one-storey, mechanized methods of warehousing, materials handling, and production. Employee parking lots have become increasingly necessary. To satisfy the resulting land requiremens in a closely built-up district is likely to be extremely costly.

Growing traffic congestion in central districts has also helped to push industry outward.[6]

Thus, in certain senses and to a certain degree, decentralization does appear to be occurring. It is important to note, however, firstly, that the movement is primarily a relative one—old plants are not being uprooted or abandoned so much as new plants are being built in new places — and, secondly, that the radius of decentralization may be long or short. A Maritimer, a resident of a town in Eastern Ontario, and a tax-payer in a Toronto

[5]Snow clearance may have been a factor of considerable importance in determining industrial location in Canada. It is not so long since almost the only roads or streets which were kept clear of snow in the winter were those on which street cars ran.

[6]A useful summary of a number of the forces making for decentralization is given on pp. 31 and 32 of *The Trucking Industry and the Next 25 Years*, a brief submitted to the Royal Commission by Canadian Trucking Associations Inc.

dormitory suburb may all express themselves in favour of industrial decentralization, but they probably have different distances in mind. From the point of view of the effect on urban growth, one may distinguish three sorts of relative shift: from a large urban area in a heavily industrialized region to a similar area in a less industrialized region; from a large metropolis to a smaller city or town; and from a downtown district to a suburb. There can be decentralization from Toronto to Halifax; from Toronto to Arnprior; and from central Toronto to North York.

In the calculations which follow, the populations of the 15 census metropolitan areas are forecast *en bloc*, as are the populations of 21 other major urban areas and of all other urban areas respectively. Furthermore, the terms "metropolitan area" and "major urban area" are deliberately given a broad interpretation in order to allow for what may be great changes in the shape and consistency of such areas between now and 1980. A central city closely ringed by suburbs: a more sprawling but still distinguishable entity; a built-up nucleus surrounded by a green belt and designated satellite towns —any of these would qualify as a single metropolitan or urban area.

Thus the forecast should not in principle be affected by a greater or lesser degree of decentralization from central cities to their own suburbs or satellites, or from place to place within the metropolitan, other major urban, or other urban groups respectively. There remains decentralization from group to group—from large metropolises to other urban areas, and from medium-sized urban areas to smaller ones. If it were thought that this sort of movement was likely to become a good deal more important than it has been in the fairly recent past, then the basis of the forecast could be brought under attack. It could be argued that the forecast seriously overstated the probable population growth of the larger places and understated that of the smaller ones.

Some of the factors tending to give industry a wider choice of location have been described. There seems no question but that, for some industries at least, a plant site in a small town or city is a more feasible proposition than it used to be. It is thought that automation may be a factor making for greater industrial decentralization. The automated plant may have to be a completely new one; if so, the opportunity arises to seek out a new site at some distance from the old.[7]

The very growth of an industry or of a firm in an industry may increase the number of occasions on which a small-town or small-city plant site can be considered. A decision may be made to set up separate plants for individual products or related groups of products.[8] A big, multiplant firm with a

[7] *Probable Effects of Increasing Mechanization in Industry*, p. 46, a study prepared for the Royal Commission by the Canadian Congress of Labour.

[8] See Barber, C. L., *The Canadian Electrical Manufacturing Industry*, p. 5, a study prepared for the Royal Commission.

mature organization and platoons of seasoned personnel may not have to worry so much about where the managers and senior technicians for a new plant will be obtained.[9]

The smaller centre may be able to offer certain cost advantages to industry and its workers—not only lower land values, but lower taxes (probably reflecting in part lower per capita requirements of social capital) and shorter journeys to work.[10] Some managements may be attracted by lower prevailing wage scales and a lesser degree of union organization.

Yet one cannot help thinking that despite all the developments which have tended to shake industry loose from its old, cramped citadels, the magnetism of the large metropolitan or urban area, broadly defined, will remain very powerful. For many industries there will still be great advantages in being near or within, if not actually in the middle of, a large urban market and a large pool of skilled labour. The word "pool" should be emphasized: it is not merely a question of getting skilled people but of being able to replace them readily if they should choose to move on. Then, too, labour requirements may be subject to unavoidable fluctuations which can be absorbed more easily and amicably in a large centre than in a small town.

Proximity to a wide range of subcontractors, producers of semi-finished materials, and suppliers of repair, servicing, warehousing and banking facilities, will also continue to be a significant drawing card. One would imagine that prompt repair and servicing would be of the utmost importance to highly automated industries characterized by long production runs and large volumes of output.[11]

It should be remembered that many of what could now reasonably be regarded as detached towns or cities will probably become absorbed, industries and all, into expanding urban entities nearby. If they are designated as satellites, they may be able to continue offering some of the locational advantages of smaller places.

The question which has to be asked is not whether industrial plants will be located in smaller cities and towns—obviously, some will; and new towns will spring up around new industries—but whether the movement will become so much more widespread and significant than it was in the decade 1941-51 (here used as a base period) that the big urban places will come to absorb a very much smaller share of the national population increase. The answer suggested here is: *No—not if the locational decision is left for in-*

[9]See Woodbury, C., assisted by Cliffe, F., "Industrial Location and Urban Redevelopment", *The Future of Cities and Urban Redevelopment*, C. Woodbury, editor, p. 123.

[10]Bank of Nova Scotia, *op. cit.*

[11]Proximity must, needless to say, be measured in hours as well as in miles. If efforts to keep the metropolitan traffic problem under control prove seriously inadequate, the locational advantages of larger places will tend to be offset.

dustry to make. There do not seem to be enough grounds for thinking that the attractive force of the metropolis (again, broadly defined) has been all that seriously impaired. Much future decentralization seems likely to take the form of a wider diffusion of industry through large and expanding metropolitan areas.[12]

The above argument is entirely *a priori* and stands open to empirical assault from anyone who feels that the available data foreshadow a much stronger trend toward the smaller centre.[13] It is often possible to establish with reasonable certainty the trend of location for a particular industry; but the trend for all industry is much more difficult to discern. Students of the subject in the United States seem as yet reluctant to draw any very definite conclusions. In one study, the following statement is made: "From an overall view of the patterns of industrial location over the past half century or so, their chief characteristic is their relative stability."[14]

To question the likelihood of a sharply stepped-up rate of decentralization is not of course to deny its possible desirability. Many reasons have been put forward for locating more industry away from the larger centres: vulnerability to nuclear attack would be reduced, the cost of social capital might be lowered, etc. What would be argued here is that those who favour a much greater relative dispersion of industry to smaller towns and cities should not feel assured that the movement will occur of itself, without special push or inducement.

Past and Future Urban Growth

In 1941, some 62% of the population of Canada was classified as urban, i.e. as residing in cities, towns and villages of 1,000 or more (whether incorporated or not) or in other settlements deemed to belong to census metropolitan areas. Ten years earlier, by the same definition, the urban population accounted for 57% of the Canadian total.

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[12]No position is being taken here on the possibility of a greater degree of long-distance, interregional decentralization—from, say, central Canada to the Atlantic Provinces or the Prairie Provinces. It is being argued, however, that to the extent that such shifts occur, they will tend to be toward the larger urban places of the regions concerned—toward the Halifaxes, Winnipegs, Reginas, etc.

[13]A few recent figures may be of interest. The January 1956 issue of *Industrial Canada* contains a "Record of Industrial Development" for 1955, compiled from reports in the magazine during the year. The list includes plant erections and extensions, expansions of production, and other projects, planned and under way. No claim is made for the completeness of the tabulations, but they are believed to include all the important developments of the year.

Of the 297 projects listed, 87 were in the Toronto metropolitan area, 89 in other census metropolitan areas, 34 in what are here called "other major urban areas", and 87 in other areas.

A second list covers "new Canadian industries established in 1955". Of a total of 96 projects, 37 were in the Toronto metropolitan area, 29 in other census metropolitan areas, nine in other major urban areas, and 21 in other areas.

The Department of Trade and Commerce publishes a regional supplement to its annual *Private and Public Investment in Canada: Outlook*, giving figures of the value of new capital expenditure in manufacturing in census metropolitan areas. From these it would appear that over the period 1953-55 inclusive, some 10.5% of total new investment in Canadian manufacturing took place in the Toronto metropolitan area, and a further 32.4% in other census metropolitan areas.

It will be noted that these figures cover manufacturing only, which probably explains why Toronto's predominance seems less marked than in the *Industrial Canada* listings. The 1955 figures are estimates, and the 1954 ones are preliminary.

[14]Woodbury, C. and Cliffe, F., *op. cit.*, p. 286.

Table 4

URBAN AND RURAL POPULATION IN CANADA

	(thousands of persons in 1951)						(urban population as percentage of total population)					
	by 1941 definition[a]			by 1951 definition[b]			by 1941 definition[a]				by 1951 definition[b]	
	Urban	Rural	Total	Urban	Rural	Total	1921	1931	1941	1951	1941	1951
Newfoundland	104	257	361	155	207	361	n.a.	n.a.	18[c]	29	37[c]	43
Prince Edward Island	28	71	98	25	74	98	21	23	25	28	22	25
Nova Scotia	298	345	643	345	298	643	43	45	46	46	50	54
New Brunswick	168	348	516	215	301	516	32	32	31	27	28	42
Quebec	2,729	1,327	4,056	2,697	1,358	4,056	56	63	63	67	62	67
Ontario	2,753	1,844	4,598	3,251	1,346	4,598	58	61	62	60	68	71
Manitoba	384	392	776	440	337	776	43	45	44	49	49	57
Saskatchewan	371	461	832	252	579	832	29	32	33	45	21	30
Alberta	488	451	939	450	490	939	38	38	39	52	33	48
British Columbia	615	550	1,165	793	372	1,165	47	57	54	53	67	68
Yukon	4	4	9	3	7	9	25	25	40	44	20	30
Northwest Territories	—	16	16	3	13	16	—	—	—	—	8	19
Canada	7,941	6,068	14,009	8,628	5,381	14,009	50	54	54	57	57	62

a Urban population includes all persons residing within boundaries of incorporated cities, towns and villages.

b Urban population includes all persons residing in cities, towns and villages of 1,000 or over, whether incorporated or not, as well as the population of all parts of census metropolitan areas.

c 1945 figures, not included in Canadian total.

SOURCE: *Census of Canada 1951*, Vol. I, Dominion Bureau of Statistics.

For the purposes of the 1951 census, 15 areas, all but two of which proved to have populations of more than 100,000, were defined as metropolitan—i.e., as consisting of larger cities with "well-defined satellite communities[15] in close economic, geographical and social relationship to the city proper". One of these areas, figuring for the first time in a Canadian census, was that of St. John's, Nfld., with a population of 67,749. Including St. John's, the aggregate population of census metropolitan areas in 1951 was 5,189,775, or 37% of the total population of Canada. Excluding St. John's, the figure was 5,122,026, or again about 37% of the total Canadian population less that of Newfoundland. In 1941, the same 14 geographical areas contained 4,032,355 persons, or about 35% of the population of Canada. Certain parts of these areas were, of course, not yet metropolitan, at least by the criteria of the 1951 census; many were still open farmland. To that extent, the 1941 figure is too high, and what may be called the true growth of the 14 metropolises over the decade is understated.

The concept of the metropolitan area is extremely important to this study; it will shortly be extended to cover a number of "other major urban areas" as well. It is important because the problem of providing the wide range of social capital characteristically required by large and medium-sized cities cannot possibly be considered without reference to their surrounding suburbs and "fringe" areas. Who, for instance, would dream of studying the arterial road and street requirements of the city of Vancouver without taking account of Burnaby, New Westminster, North and West Vancouver, and the other neighbouring municipalities which daily pour so many thousands of cars and people into the central district? That urban problems are no respecters of municipal boundaries is a fact, alas, all too familiar in Canada in recent years.

The question, *Where does Montreal, or Toronto, or Winnipeg begin?*, is not an easy one to answer. It all depends on the purpose in mind, on what caused the question to be asked in the first place. For many planning purposes, the census definition is not broad enough: the planner may wish to include in his purview some of the open country lying in the path of development, the immediate milk-shed and market gardening areas, some potential satellites perhaps. There is belief in some circles that thinking on urban problems will have to be more and more in terms of extensive "urban regions". It is not inconceivable that the entire area bordering the western end of Lake Ontario, from, say, Oshawa to Niagara-on-the-Lake, may one day come to be regarded as a single urban region.

From a social capital standpoint and in relation to present patterns of urban land occupancy, the census definition is perhaps not too unsatisfactory: i.e., it probably gives a reasonably good idea of the area over which the demand for social capital tends to be of an urban character. It is, natur-

[15]In the rest of this chapter, the term "satellite" is used in a special sense. It is to be taken to mean, not an ordinary suburb, but a more self-contained entity which may be separated from its parent by a green belt but still bears a significant degree of economic, geographical and social relationship to the city proper.

ally, far from being a lapidary precept, and will doubtless be changed in the future if conditions warrant such a step.

In analyzing past urban growth with the object of devising a projection into the future, it has been decided to use, not the census metropolitan figures quoted above, but the somewhat different figures (based on census data) published by the Bank of Nova Scotia in its *Monthly Review* for July, 1955.[16] These figures, which again exclude Newfoundland, cover not only the 14 metropolitan areas already mentioned, but 20 other major urban areas with populations of 40,000 or more. (To these is here added Guelph, which was treated as a major urban area in the 1951 census, to make a grand total of 35.) A wider picture is thus obtained; and an additional advantage is that the figures extend back to 1921, as is not the case with the census metropolitan figures. The 35 areas—there are 36 if Hull is separated from Ottawa —are made up as of 1951 on the same principles as census metropolitan areas; they are then held geographically constant over the previous 30 years. Again, the true urban and metropolitan growth is understated; but the only alternative to holding the areas constant would be a series of arbitrary decisions as to just when certain fringe settlements reached the stage where they might be considered "well-defined satellite communities in close . . . relationship" with their neighbouring cities. Actually, what the figures measure is not the growth of Metropolitan Winnipeg, Greater Sudbury etc., but the growth of population in the areas which were deemed to constitute Metropolitan Winnipeg, Greater Sudbury etc., in 1951.

It would seem from the table that in 1921, some 38% of the population of Canada lived in the 35 metropolitan and urban areas under consideration. By 1941, the percentage had risen to just under 44; and by 1951, to 47. Clearly, the areas as a group grew a good deal faster in terms of population than did the country at large. Put in another way, this means that between 1921 and 1951 the 14 metropolitan areas absorbed fully 50% of the national population increase, while the other 21 areas absorbed a further 13%. Over the shorter period 1941-51, the 14 metropolitan areas absorbed 51% of the total increase, while the 21 other areas accounted for 14%.

We have already assumed that the total population of Canada, exclusive of the Yukon and Northwest Territories, will reach 26,650,000 by 1980, representing an increase of 12,666,000 over 1951. Excluding Newfoundland for the moment, one might reduce the latter figure to 12,400,000. What would happen if the 14 metropolises and 21 other major urban places were to share in this increase in the same proportion in which they shared in the increase of 1921-51? The 14 metropolises would attain an aggregate population of about 11,400,000; the other major urban places, 2,900,000. Both groups, in other words, would undergo more than a doubling of their populations.

[16] "The Trend to Bigger Cities", Bank of Nova Scotia *Monthly Review*, July 1955

Table 5

GROWTH OF METROPOLITAN AND OTHER MAJOR URBAN AREAS

	(population in thousands)				(percentage of total population of Canada)			
	1921	1931	1941	1951	1921	1931	1941	1951
14 metropolitan areas[a]	2,728	3,631	4,071[b]	5,160[b]	31.1%	35.0%	35.4%[b]	37.9%[b]
21 other major urban areas[c]	627	779	959	1,261	7.1%	7.5%	8.3%	9.3%
All other areas, urban and rural	5.421	5,953	6,460	7,202	61.8%	57.5%	56.3%	52.8%
Total population of Canada, excl. Nfld., Yukon and N.W.T.	8,776	10,363	11,490	13,623	100.0%	100.0%	100.0%	100.0%

a Halifax, Saint John, Quebec, Montreal, Ottawa-Hull, Toronto, Hamilton, London, Windsor, Winnipeg, Calgary, Edmonton, Vancouver, Victoria.

b Slightly different from census figures quoted earlier. In order to hold areas constant back to 1921, it was necessary to deviate from 1951 census metropolitan areas in some cases.

c Sydney-Glace Bay, Moncton, Arvida-Chicoutimi, Sherbrooke, Shawinigan Falls, Three Rivers, Kingston, Peterborough, Oshawa, Niagara Falls, St. Catharines, Welland-Port Colborne, Brantford, Guelph, Kitchener, Sarnia, Sudbury, Sault Ste. Marie, Fort William-Port Arthur, Regina, Saskatoon.

SOURCES: "The Trend to Bigger Cities", Bank of Nova Scotia *Monthly Review*, July, 1955, and *Census of Canada 1951*, Vol. I, Dominion Bureau of Statistics.

Table 6

PERCENTAGE SHARES IN NATIONAL POPULATION INCREASE

	1921-51	1941-51
14 metropolitan areas	50.18%	51.05%
21 other major urban areas	13.08%	14.16%

SOURCES: As for preceding table.

If the projection were based on 1941-51 shares in the national population increase, the metropolises would reach a total of nearly 11,500,000, while the others would attain 3,000,000. The metropolises would contain some 44% of the total population, while the others, many of them presumably long since risen to census metropolitan status, would account for between 11% and 12%. With growth of this order, most if not all of the second group would have passed the 100,000 mark, so that more than half the population of Canada would be living in urban and metropolitan areas of 100,000 or more.

The foregoing is, subject to some adjustment, the urban population assumption of this study so far as the larger places are concerned. The period 1941-51, rather than 1921-51, is used as the base of projection on the supposition that nothing on the scale of the Great Depression will occur again. Over the decade of the '30's, as is indicated by Table 4, the ratio of urban population (as then defined) to total population remained almost static, even though the metropolitan and other major urban groups continued to show perceptibly faster rates of growth than the country as a whole. The decade 1941-51 was hardly a normal one either, but seems a better base period to employ so long as one is thinking in terms of reasonably steady economic growth.

The crudity and arbitrariness of the projection hardly require emphasizing. Needless to say, it is not for a moment supposed that these massive net additions to population will be wholly accommodated within the metropolitan and other major urban areas as they stood at the time of the 1951 census. The areas will be bigger; they will probably be defined differently. Growth and the automobile alone can be relied upon to produce great changes in the very nature of metropolitan and urban areas. It is to be hoped that deliberate planning will also be a powerful influence. All that the projection seeks to do is to give some idea of what might conceivably be the total population of those entities which will still be called Montreal, Toronto, etc., even though they will probably be strikingly different in some respects from the entities we know today—different in geographical size, different in administrative organization, different in distributions of land use.

Movements In Rural Population

The rural population is divided for census purposes into farm and non-farm population. The farm element includes those who live on farms in rural

areas, while the non-farm element includes all other persons living in rural areas. Residents of country hamlets and small fishing ports fall into the latter category, as do an indeterminate number of people who earn most of their income in cities and towns but live in communities too thinly settled to be called urban.

Changes in the rural population between 1931 and 1951 are shown in Table 7. Past experience is not thought to be a very good guide to the future here: there are reasons, for example, for believing that the rural farm population will not go on declining at the 1941-51 rate over the next 25 years.[17]

In the Royal Commission agricultural study, a decline of nearly 24% in the farm labour force over the period 1951-80 is forecast. There would be further mechanization of farming operations, and an increase in the average size of farm. Most of the decrease in the labour force would have occurred by 1965; thereafter, the average annual rate of decline would be small.

The farm labour force and the rural farm population are far from being the same thing, and a change in one does not imply an equivalent percentage change in the other. A farmer's son may leave the farm labour force by taking a full-time job in a nearby town, but so long as he continues to live on the farm he is still in the rural farm population. If a hired man decides to leave a farm where, apart from himself, there are a farmer, the farmer's wife, a son who works full-time on the farm, and a daughter who is still going to school, the labour force of that farm will drop by 33 1/3%, but its population will decline by only 20%.

For reasons suggested by the foregoing examples, the drop in the rural farm population is not likely to be as great, percentagewise, as the drop in the farm labour force. Some allowance should be made, however, for the spread of the practice among farmers—particularly prairie wheat farmers—of taking up residence in town while continuing to farm their lands.[18] In this instance, the rural farm population declines but the farm labour force remains unchanged. From a housing and social capital standpoint, the transplanted farmer and his family are thorough urbanites: they want town housing and town services and they are in a position to get them.

All things considered, a decline of 17%—from 2,827,000 in 1951 to 2,346,000 in 1980—might be a reasonable guess as to the future of the rural farm population.

[17]Some of the 1941-51 decline in the rural farm population may have been carried over from the '30's. The lack of urban jobs during the depression is believed to have caused young people in many parts of Canada to remain on family farms or even to return there when they would otherwise have taken city employment.

[18]At the time of the 1951 census, 16% of Saskatchewan farmers were found to be living in town. In some parts of the province, the percentage was as high as 30. (*Rural Roads and Local Government*, Province of Saskatchewan, Royal Commission on Agriculture and Rural Life, Report No. 4, p. 61.)

Table 7

RURAL[a] POPULATION, FARM AND NON-FARM, 1931-51

1. *Thousands of persons*[b]

	1931			1941			1951		
	Farm	Non-farm	Total rural	Farm	Non-farm	Total rural	Farm	Non-farm	Total rural
Prince Edward Island	55	15	71	51	23	74	47	27	74
Nova Scotia	175	109	284	142	164	305	113	200	312
New Brunswick	178	92	270	162	140	302	146	176	322
Quebec	759	407	1,166	827	489	1,315	769	632	1,401
Ontario	784	461	1,245	691	605	1,297	678	786	1,465
Manitoba	252	107	360	246	136	382	214	123	337
Saskatchewan	563	171	735	514	191	705	398	182	581
Alberta	372	132	504	382	164	546	340	161	501
British Columbia	99	174	273	98	212	310	110	272	382
Canada (excl. Newfoundland, Yukon and Northwest Territories)	3,238	1,670	4,908	3,113	2,123	5,236	2,816	2,560	5,375

2. *Percentage change*[c]

	1931-41			1941-51		
	Farm	Non-farm	Total rural	Farm	Non-farm	Total rural
Prince Edward Island	— 8.0	49.4	4.5	— 8.2	16.6	— 0.5
Nova Scotia	—19.1	50.1	7.5	—20.3	22.0	2.4
New Brunswick	— 8.8	51.3	11.8	— 9.9	26.0	6.7
Quebec	9.0	19.9	12.8	— 7.0	29.4	6.5
Ontario	—11.9	31.3	4.1	— 1.8	29.9	13.0
Manitoba	— 2.6	26.8	6.2	—12.8	—10.1	—11.8
Saskatchewan	— 8.7	11.3	— 4.0	—22.6	— 4.4	—17.7
Alberta	2.6	24.3	8.3	—11.0	— 1.5	— 8.1
British Columbia	— 1.2	21.8	13.5	12.0	28.4	23.3
Canada (excl. Newfoundland, Yukon and Northwest Territories)	— 3.9	27.1	6.7	— 9.5	20.5	2.7

a According to 1951 census definition of rural, except that people living in unincorporated places of 1,000 and over were included in the rural population in this table since they could not be separated out in the 1931 and 1941 census figures

b Detail does not always add to total on account of rounding.

c Percentages calculated on unrounded figures.

SOURCE: *Census of Canada 1951*, Vol. X, p. 45, Dominion Bureau of Statistics.

The rural non-farm population is an especially difficult category to predict because its composition is so disparate. The part of it which consists of evening escapees from the city would seem likely to increase, perhaps substantially in relative terms. On the other hand, the hoped-for rationalization of the Newfoundland fishing industry would of its very nature lead to a movement of population out of small outports into larger towns. Meanwhile, in agricultural regions, and especially on the prairies, a combination of better roads and fewer farmers may well work against small country service centres in favour of places large enough to be designated as urban.

On balance, the rural non-farm population might show an increase of perhaps 30% over the period 1951-80. Much will depend on what the census authorities choose to call urban: if, in response to a great spread of "exurbia", of low-density housing on the extreme fringe, they begin to regard certain kinds of area as urban that are not so regarded today, the rural non-farm category may lose part of what is probably its most dynamic element. It is here assumed, in a vague way, that the census conception of "urban" will probably be broadened to some extent, but that there will still be elements of population essentially urban in orientation, if not in place of residence, which will continue to be called rural.

Final Calculations

In Table 8, the forecasts of urban and rural population which have so far been made are brought together. The inclusion of St. John's, Nfld., in the metropolitan category and an increase on behalf of Toronto, whose experience up to 1951 possibly a little belies its future prospects, boost the relevant total to a round 12 million. The 21 other major urban places remain at 3 million; the rural farm population is estimated at 2,346,000, and the rural non-farm population at 3,294,000. Subtracting these figures from the national population forecast leaves 6,010,000 in the "other urban" category.

Thus, according to the forecast, the 1980 population of Canada would be 79% urban, compared with 62% in 1951. Montreal and Toronto might have populations of between 2.5 million and three million each, and Vancouver might have attained something between one million and 1.5 million.

Comparison of rates of change in the three urban and two rural categories is complicated by the use of Bank of Nova Scotia figures as the 1951 point of departure for the metropolises and major urban places, and of Dominion Bureau of Statistics figures for rural areas. The Bank of Nova Scotia, after estimating the populations of the metropolises and major urban areas, did not attempt to divide the rest of the national population into urban and rural elements. In the second column of Part I of the table, a 1951 figure for "other urban" areas is derived by subtracting from the national population the Bank of Nova Scotia figures for the metropolitan and other major

urban areas and the D.B.S. figures for rural areas. The procedure is not really legitimate in that the Bank of Nova Scotia figures include some areas which the census called rural. Thus if it is desired to compare forecast rates of change in all three urban categories, it should be borne in mind that the 1951 "other urban" figure is too low, and the indicated percentage rate of increase to 1980 (182%) consequently too high.

Table 8

FORECAST OF URBAN-RURAL DISTRIBUTION OF POPULATION

1. *Population in thousands*

	1951		1980
	D.B.S.	Bank of Nova Scotia	Forecast
15 metropolises	5,190	5,228[a]	12,000
21 other major urban places	3,432	1,261[b]	3,000
Other urban		(2,134) (residual)	(6,010) (residual)
Rural non-farm	2,534	2,534 (D.B.S.)	3,294
Rural farm	2,827	2,827 (D.B.S.)	2,346
Total population of Canada, excl. Yukon and N.W.T.	13,984	13,984	26,650

2. *Percentage distribution of population*

15 metropolises	37%	37%	45%
21 other major urban places	25%	9%	11%
Other urban		16%	23%
Rural non-farm	18%	18%	12%
Rural farm	20%	20%	9%
Total population of Canada, excl. Yukon and N.W.T.	100%	100%	100%

3. *Percentage changes*

	1951-80 (1951 per D.B.S.)	1951-80 (1951 per Bank of Nova Scotia)
15 metropolises	+131%	+130%
21 other major urban places	+163%	+138%
Other urban		(+182%)
Rural non-farm	+ 30%	+ 30% (1951, D.B.S.)
Rural farm	− 17%	− 17% (1951, D.B.S.)
Total population of Canada, excl. Yukon and N.W.T.	+ 91%	+ 91%

NOTE: For names of metropolises and major urban places, see Table 5

a St. John's, Newfoundland, per D.B.S.

b Guelph, Ontario, per D.B.S.

SOURCES OF 1951 DATA: *Census of Canada 1951*, Vol. I, Dominion Bureau of Statistics, and "The Trend to Bigger Cities", Bank of Nova Scotia *Monthly Review*, July 1955

If the 1951 population of the metropolitan and other *major* urban areas is totalled from census data in so far as this can be done without encroaching on the rural categories, the indicated increase in the "other urban" category drops to 158%. Thus for purposes of comparison with the 130% and 138% increases in metropolitan and major urban populations respectively, the increase in the "other urban" population should be deemed to lie probably somewhere between 158% and 182%.[19]

[19]Into this category, it may be noted, would fall the Kitimats of the future—new towns and cities springing up in the vicinity of certain kinds of resource development.

Strictly speaking, there are only two comparisons which are mathematically respectable. If the Bank of Nova Scotia figures are used as the 1951 starting point, comparison should be on the basis of three categories: metropolises, +130%; other major urban places, +138%; and all other areas, urban and rural,[20] +55%. Alternatively, the D.B.S. figures can be taken as the 1951 point of departure, and in this case the comparison runs as follows: metropolises +131%; all other urban areas, +163%; rural non-farm areas, +30%; and rural farm areas, —17%.

The forecast of a slower rate of population growth for the metropolises than for other urban areas does not indicate second thoughts on industrial decentralization. The contention was, it will be recalled, not that there would be no movement of industry to smaller towns and cities, but that the movement would be no greater, relatively, than it was in the 1941-51 base period. The metropolitan forecast continues to be based on the metropolitan share of national population growth during that period, plus an upward adjustment on behalf of Toronto. The forecast of population in other major urban areas remains similarly based.

Percentage rates of increase are in any event meaningful only in terms of the aggregates with which one starts. A Toronto or a Montreal takes a lot of catching up to. Notwithstanding their slower rate of growth, the 15 metropolises will, by the assumptions of the forecast, acquire more than half the net increase in the national population over the period 1951-80.

Urban Growth by Periods

A long-term forecast of urban growth is a dubious enough venture in itself; to attempt a breakdown by periods would appear to be compounding risk. Nevertheless, it is interesting to speculate as to the time pattern of urbanization over the next 25 years. If the forecast decline in the rural farm population is allotted to periods in the same proportions as the forecast decline in the farm labour force, and if it is assumed that the forecast increase in the rural non-farm population will be similarly related to the increase in the national population, the following period breakdown is obtained:

Table 9

FORECAST OF URBAN GROWTH BY PERIODS

	1951	1965	1970	1975	1980
Urban population (000).....	8,623	14,269	16,292	18,506	21,010
Rural non-farm population (000)..	2,534	2,866	2,993	3,134	3,294
Rural farm population (000).....	2,827	2,385	2,355	2,350	2,346
Total population (excl. Yukon and N.W.T.) (000).....	13,984	19,520	21,640	23,990	26,650
Urban population as % of total..	62%	73%	75%	77%	79%

[20]That is (with reference to Table 8, Part I, columns 2 and 3) "other urban", "rural non-farm" and "rural farm".

It should be noted that in those portions of the study where the forecast of urban growth actually enters into the calculation of capital requirements (*e.g.*, for water and sewerage systems), a rough allowance is made for urban growth between 1951 and 1955.

Some Implications of Urban Growth

Assuming, then, that the next 25 years will be characterized by pronounced urban growth and by a doubling or a more-than-doubling of the present populations of the larger urban places, one may draw certain inferences with regard to housing and social capital. The general point has been made that urban communities require more social capital than rural ones and that the per capita investment in such facilities tends to be higher in large metropolitan and urban areas than in smaller cities and towns. The solution of metropolitan traffic problems, for example, is likely to require far more spectacular and expensive remedies than need be contemplated by cities of 20,000 population. The provision of recreational facilities is likely to be more organized and costly in the midst of the asphalt jungle than in places where the open country is still within easy reach.

Problems of the Centre

If the larger metropolises, in particular, double or more than double in geographical size and population, various kinds of pressure already bearing on their central districts will be intensified. The most tangible pressure will be that of traffic. Forecasts of vehicle registrations and of vehicle travel suggest that the volume of motor traffic in Canada may about triple over the next 25 years. Just how a reasonable freedom of movement into and out of downtown areas can be preserved in the face of such growth is a matter of considerable controversy. Some of the measures which have been proposed are discussed in Chapter 6.

There are Cassandras who seem to visualize a kind of ultimate traffic jam, a final and complete choking up of vehicular movement in downtown areas. Actually, it is unlikely that things would ever quite reach this pass, even in a situation of complete *laissez-faire*. A steady worsening of downtown traffic conditions must in the long run bring about—already has brought about, to some extent—its own solution: the migration of retail and other establishments to districts where movement is freer.

Is this a bad thing? The rise of neighbourhood shopping and recreational centres has surely both logic and convenience to recommend it. Why not then allow the process to continue and broaden, with cities assuming more and more the character of vast, comparatively low-density sprawls, dotted throughout their extent with outcrops of commercial and industrial development? Why should massive effort and expense be devoted to the admittedly

difficult task of maintaining downtown business districts in a good state of economic health?

The short answer is that downtown business districts constitute very large aggregations of capital (including social capital) and of taxable assessment. There is a great deal of money invested in them; they are an important source of municipal revenue. But they can be justified on other grounds as well. There are certain functions for which they are peculiarly well suited. Various kinds of enterprise, notably in the financial field, are still best carried on in close proximity to one another. Large department stores, offering a wider variety of merchandise than most neighbourhood outlets can hope to emulate, must generally have more or less central locations; so too must the majority of large theatres and concert halls and major-league hockey arenas. The great virtue of a metropolis is that it can provide for activities which never at one time drew more than a minority of the total population yet for that very reason must have a large population on which to draw. If some of these activities were to be gradually suffocated by traffic congestion—if the big city were to become, for cultural, recreational and retailing purposes, little more than an aggregation of suburbs—not only the city but the nation at large would be distinctly the poorer.

Finally, "downtown" would seem to have a psychological function—as a focus and symbol, as an embodiment of achievement and civic pride. One could wish that some Canadian downtown districts fulfilled this function better. Perhaps in the future they will.

Another of the pressures which growth is likely to intensify is that for redevelopment of the older parts of cities. An impression may have been created that redevelopment is a discovery of the 1950's. It is, in fact, almost as old as cities themselves. What is new is the growing interest in publicly sponsored schemes for the redevelopment and renewal of comparatively large areas.

Land values near the centre of a city and the pattern of land uses are always undergoing change. Zoning regulations permitting, houses are replaced by apartments or commercial premises. The main business district tends to grow upward and outward—usually more the former than the latter. Houses and other buildings are destroyed to make way for parking facilities and traffic improvements.

Unhappily, "normal" redevelopment of this sort cannot be relied upon to maintain the whole of the central area in a satisfactory state. Patches and belts of housing adjacent to the business core are not replaced but slip gradually into a condition of blight. Age and weather do their work; the rising tide of traffic also helps to make such neighbourhoods less desirable as places to live. If zoning has not been strict, tracts of housing may be shot through

with land uses which should have no place in a residential quarter. Overcrowding may be common.

Publicly sponsored redevelopment is sometimes visualized in terms of slum clearance—of the wholesale levelling of blocks of sub-standard housing. There should certainly be some of this, but the modern conception of redevelopment is not so simple. For one thing, the condition of blight is not likely to be uniform and general. Some structures may indeed have got beyond redemption; but others may be sound and worth preserving. Still others may be susceptible of repair and improvement which would considerably prolong their useful lives.

Furthermore, as is now well recognized, there can be no question of simply turning people out of bad housing and virtually forcing them to start new slums in other parts of the city. Better accommodation should be available for them, and it should be accommodation within their means, which are almost certain to be small. Possibly, some of the former residents may be rehoused in new structures on the old site. On the other hand, the decision may be reached that the district is basically unsuited to housing and should be turned over to other uses; and in this case rehousing must take place elsewhere.

It is impossible to foresee at this stage just what future publicly sponsored redevelopment schemes are likely to bring forth. Conditions vary greatly from city to city. If one is to judge from the recently published Toronto urban renewal study[21], which may be something of a model for other cities, large-scale redevelopment will be preceded by detailed study, not only of the district immediately affected, but also of the growth and requirements of the entire urban area. Only when this has been concluded will a decision be reached as to the pattern of redevelopment that would be desirable. Where a proposed redevelopment borders on or partly includes a downtown business district, considerable attention will be paid to the requirements of that district. Should more open space be provided for downtown employees and shoppers? Should housing be built that will appeal to people who work downtown and who would be glad to live near their jobs?

The extent and character of future redevelopment will have an important bearing on housing and social capital requirements. Some new housing and social capital will be built; some will be destroyed or rendered redundant; and some will be restored and given a new lease on life. Where land once occupied by housing is turned over to other uses, a surplus of such things as churches and schools will be likely to emerge. Meanwhile, the people who have moved away will be creating new housing and social capital requirements in other districts.

[21] *Urban Renewal: A Study of the City of Toronto, 1956,* Advisory Committee on the Urban Renewal Study.

Expansion at the Periphery

If urban growth were always a rational, orderly process, the forecasting of housing and social capital requirements would be a great deal simpler than it is. Occasions arise when it is possible to plan a town or city from its very inception—to foresee its approximate size, and to provide in advance for most of its basic needs. Given these conditions, it becomes possible to create a Kitimat, a Devon, a Manitouwadge, or an Oromocto (Gagetown). The growth of most cities and towns, however, is not nearly so predictable. Their economic base is more varied; their expansion is the consequence of many individual, corporate and governmental decisions; and the planning process, where it can be said to exist, is more a matter of trying to guide and influence these decisions so that the total result will be in the broadest sense pleasing, consistent and fundamentally economic.

Judged by these criteria, the outward spread of urban areas during the last ten years presents a highly varied picture. In some places, new residential and industrial districts have been laid out with due regard to the long-run interests of the communities concerned and of the larger urban entities of which they form part. In other places, expansion has been haphazard and ill-co-ordinated. The problems to which rapid growth must in any event give rise have been unnecessarily aggravated, and the ultimate expense of providing services and amenities has been rendered far higher than it need have been. To a very real extent, the cost of future social capital requirements will depend on how well the lessons of the postwar period have been learned.

Unlike its stockaded forbear, the modern Canadian city does not come to an end suddenly—the physical frontier between town and country is typically neither smooth nor well-defined. The built-up area will generally be found to straggle out along a few well-maintained provincial highways. Houses, industrial plants, filling stations, motels and restaurants succeed one another with gradually decreasing frequency until the open country is reached. From the air, these long projections may seem like the arms of a star; to the motorist they have rather the appearance of a sort of gauntlet which he must run in order to enter or leave the city.

Aesthetic considerations apart, such ribbon development has two important disadvantages. The first is that it is extremely expensive to provide with sewer and water services, if indeed it is provided with them at all. Trunk sewer and water mains must be run far out of the city in order to serve a narrow, built-up strip which may rarely be more than two or three lots deep on either side of the road. Years may pass before the spaces between the arms of the star are filled in and the original investment justified.

A second disadvantage of such development is that it ruins good highways. A high-speed, main road is constructed out of a city at a cost ranging from $70,000 to $500,000 a mile or more, only to be converted into the

most dangerous kind of obstacle course, with pedestrians scuttling across the right-of-way and vehicles pulling in and out of countless small access roads. What was meant to be a convenience to through traffic degenerates into little more than a local-service road, and a costly new artery becomes necessary years before its time.

Ribbon development is not the only uneconomic kind of urban sprawl. Sometimes there is a sort of leap-frogging: blobs of housing appear, not on the edge of the existing built-up area, but some distance away—perhaps in a hitherto rural municipality. To some extent, the phenomenon can be explained by the desire for a large lot and a countrified atmosphere; more often the basic consideration seems to be cheap land, making it possible for people to buy houses for less cash down than they would have to pay nearer the city.[22] (Sometimes, too, lower taxes or easier zoning regulations and building by-laws will serve as an attraction.)

Sanitation and water supply in such districts is typically a matter of septic tanks and individual or community wells. Sometimes a small sewage disposal plant will be installed. These arrangements may work quite well for a long time, particularly where the average lot size is large; on the other hand, they may not. The community grows: the water supply may give out or become polluted; the increasing number of septic tanks may become a health hazard. If there is a disposal plant, it may become overloaded and start polluting the water supply of other communities downstream. Residents may begin to canvass the possibilities of linking up with the sewer and water systems of the nearby metropolis. (Perhaps by this time, too, there is a growing desire for city police and fire protection.) But it may be found that to run trunk mains across the vacant or thinly settled tracts separating the fringe community from the main built-up area is a very expensive proposition. Once again, the cost per household served will be much higher than it would have been had development been more compact.

Another objection to unnecessary sprawl concerns its effect on agriculture. Haphazard urban expansion may eat up farmland (often the very farmland which provides the city with much of its milk, fruit, and vegetable supply) far faster than is necessary. This is especially distressing when the farmland concerned is limited in amount or is of a special type, as in the Fraser delta and the Niagara Fruit Belt, and when alternative building sites are available.[23]

Many of the problems associated with urban sprawl and the rise of fringe communities—the difficulties of administering what is fundamentally a single urban area through numerous municipal jurisdictions, the troubles which rural municipalities sometimes get into when unaccustomed eruptions of ur-

[22]Much remains to be learned about fringe development and why it occurs in the way it does. Chapter 4 of the *Report of the Royal Commission on the Metropolitan Development of Calgary and Edmonton* contains an informative examination of the subject.

[23]See *Brief of the Lower Mainland Regional Planning Board of British Columbia*, pp. 5, 6.

ban housing occur in their midst, the lack of industrial assessment in many fringe areas—are financial and administrative in nature and fall outside the present study. The subject here is that of certain physical requirements. Even within this limited context, the question of whether fringe growth can be better controlled is an important one. How can the all-too-human desires and needs which produce Shacktown-on-Highway and other unsatisfactory forms of fringe development be made to yield a more rational pattern of land use? How can the advance of the urban complex into the surrounding countryside be rendered more orderly and economic?

Various answers have been suggested to these questions. One frequently voiced proposal (hardly a new one—Ebenezer Howard thought of it more than half a century ago) runs somewhat as follows: that a geographic limit be set to the expansion of large urban areas; that this boundary be girdled by a greenbelt in which only what are known as low-density land uses would be permitted[24]; and that further growth be channelled into properly serviced and relatively self-contained satellite communities.[25]

Where it could be made to work, such a scheme would have great advantages. The authorities of the central metropolis would have a definite idea of the area they ultimately would be expected to service. Large, open spaces could be kept for recreational purposes at not too great a distance from the city centre. To the extent that satellite communities were able to provide jobs as well as housing for most of the people who lived in them, the traffic problem of the central metropolis would be eased. Satellite dwellers would visit the core occasionally for shopping, recreation or other purposes, but they would not aggravate the morning and evening rush hours by driving in every day to work.

The picture has many attractive features: a metropolitan area so organized could offer much of the diversity and interest of life in a big city, less some of the outstanding disadvantages. Plant sites in satellite towns might enable industry to have things both ways—to enjoy some of the benefits of small-town location without foregoing the external economies of the metropolis.

The great question is whether the thrust of urban growth, which sometimes seems to have the slow inevitability of a glacier, sometimes the wild infection of a prairie fire, can be controlled sufficiently and in time. One suspects that the effective preservation of greenbelts in the very path of speculation and development may require more radical measures than have yet been contemplated in most Canadian metropolitan areas. The municipalities with the most obvious interest in preserving a greenbelt are often not the

[24]"Such a greenbelt is not 'sterilized land', or merely park land; but in it a variety of uses are permitted—agricultural, recreational, institutional, or even industrial . . .

"The chief prohibition upon its use is that of subdivision for residential purposes. It will not be built up, at least not for some years. Should the figure for optimum size later be revised upward, as it may well be, the greenbelt can then be pushed outward." (*Report of the Royal Commission on the Metropolitan Development of Calgary and Edmonton,* Chapter 5, pp. 40 and 41.)

[25]See *A Case for Satellite Towns,* Community Planning Association of Canada.

ones within which most of the proposed belt lies. It is to be noted that the Federal District Commission recently requested power to buy greenbelt lands in the Ottawa area.

One may ask, too, whether it will be easy to keep satellites from becoming little more than pleasant, well-serviced dormitory suburbs with industries to share the tax load. There are really two questions here. Let it be assumed for the moment that industrial workers are willing and able to take up residence in the same satellites in which they work. But will they go on working there? Many urban employees change jobs quite frequently, moving from plant to plant over a wide area without necessarily moving house at the same time. It may be over-optimistic to suppose that the sheer logic of the satellite plan will induce them to drop the habit.

In any case, if the satellite is largely or wholly a new town, will the new housing in it be within the means of most industrial workers? Some remarks of Anthony Adamson may be relevant here, even though they refer to a more conventional kind of peripheral development:

> "Now we who live in the suburbs are, in the Canadian ethos, the cream of the crop. We are the worthwhile People. We are the solid Canadian Way. In other words, we believe in home-ownership and the single-family detached house. To own a single-family detached house with $11,000 on a N.H.A. mortgage requires an income of $3,986 a year. The income of the average worker in a factory is $3,104 a year. So the average worker can't very well be a home-owner and the cream of the crop. He has to live in an old house or part of an old house on Ossington and drive out of Toronto to a factory in Etobicoke to go to work, while a decent home-owner in Etobicoke has to drive into an office in Toronto to go to work. This sport is called "Rush Hour" and it gives more people cardio-vascular-renal disease than fluoridation. It is also played on strips of concrete which cost a million dollars a mile to construct."[26]

One cannot be altogether confident that the channelling of growth into satellites will necessarily contribute greatly to the solution of the metropolitan traffic problem. But the location of new housing in such a way as to facilitate proper servicing, and the dedication of large, strategically located open spaces, would certainly represent a great advance on much that has occurred since the Second World War.

In the forecasts of urban street, sewer and water-main requirements which follow, an optimistic view is taken. It is assumed, in effect, that whether the greenbelt-satellite-town approach or something else is the way of the future, the growth of built-up areas will be reasonably compact. This

[26]Adamson, Anthony, "Growing Pains in Municipal Administration", *New Brunswick Municipal Monthly*, August 1955, p. 3.

is indeed about the only kind of assumption that can be made when the basis of estimate is a standard cost unit. If, on the other hand, future peripheral growth is heavily characterized by chaotic sprawl and leap-frogging, there is no telling what the social capital cost is likely to be. But it will certainly be high.

Conclusion

The emphasis of the foregoing discussion has fallen on the larger urban areas. This does not for a moment imply that serious problems relating to social capital do not exist elsewhere. But the problems of smaller places are not wholly dissimilar in character to those of the metropolises. Furthermore, it is perhaps no bad thing to harp somewhat on the more spectacular urban entities, for while people will often boast of the expansion of their home cities or towns, there is yet a certain paradoxical reluctance to accept the fact of urban growth. The illusion persists (nourished, no doubt, by the illustrators of calendars and full-page advertisements, and by Saturday editorial page columnists) that the spirit, the essence, of Canadian life is still to be found on farms and in small towns—possibly even in the bush (Johnny Canuck leaning on his axe). Up to a point, this is healthy enough, serving as it does to inculcate a sense of history and to stimulate an appreciation of the North, the outdoors, and the underlying basis of human existence.

But when it gets to the stage of persuading us that we are not really an urban people at heart, and that we should retain a surly unconstructive dislike of cities even if we feel compelled to live in them, then it begins to do damage. If half the people of Canada are indeed soon going to be living in urban areas of 100,000 or more, it would seem essential that the conditions of urban life be faced and that as much thought and energy as possible be devoted to their improvement. To the extent that cities are mean, ugly, and inefficient, it is human indifference that makes them so. A new injection—a booster shot—of civic pride and responsibility would seem most timely.

Some Rural Problems

If increasing populations give rise to many problems, so do decreasing ones. It should not be expected that the further depopulation of some agricultural areas will necessarily occasion a reduction in social capital requirements. The need for good, all-weather roads may in fact increase. The decline in the number of pupils in some of the smaller country schools may hasten the trend toward school consolidation, as will the realization that a greater proportion of the children born on farms will have to be prepared for urban occupations. To build better roads and schools will not be easy undertakings when the number of local taxpayers is declining.

3

HOUSING

History

One of the most pressing problems that Canada has had to face since the end of the First World War has been that of providing decent shelter for its growing population. Canada emerged from the first war with a marked housing shortage and great inadequacies in its housing stock. The War Measures Act provided some relief for this situation, and the prosperity of the '20's kept it from deteriorating much further; but "the belief that the comparatively large volume of house building in the '20's which has been called by some a housing boom, brought about satisfactory housing conditions and provided homes for nearly everybody in the country, has no basis in fact. The number of dwelling units built during the '20's did not even approximate the requirements for a good standard of housing accommodation for Canadian cities and towns, and rural building probably lagged even more. Slum districts and blighted areas, including scores of dilapidated and insanitary buildings, were most clearly established in Canada toward the end of the '20's. New houses were being erected all the time, it is true, but most frequently in districts as far away as possible from the blighted areas".[1]

When the depression came in 1931, an estimated 163,000 families were not separately housed but were doubled up with other families. The poor quality of housing and the crowding of existing dwellings indicated that prosperity had not solved the housing problem. Conditions worsened as a result of the depression. Slum areas grew in number and became more congested as construction all but ceased. The general lowering of housing standards gave rise to widespread dissatisfaction. After studies made at the local level, a special Parliamentary Committee was appointed to inquire into the subject. The Committee concluded that public assistance to new housing and rehabilitation projects was greatly needed. Then, in 1935, Parliament

[1] *Report of the Advisory Committee on Reconstruction*. Vol. IV, "Housing and Community Planning", Ottawa, 1944, p. 34.

passed the Dominion Housing Act, which was superseded in 1938 by the National Housing Act. The Dominion Housing Act enabled the federal government to assist prospective home buyers, by means of loans of up to 20% of the value of land and buildings. The National Housing Act was intended to liberalize the loan policy still more, especially with respect to the small home buyer, and above all to permit the construction of low-rental projects. This last section was never operative and expired in March 1940. Under these two Acts, more than 18,000 homes were built over a period of six and a half years; but as the low-rental part of the Act of 1938 never came into effect, the situation as to slum areas was probably as bad in 1940 as in 1935.

> "The slow and hesitant recovery of residential construction in the four years before the commencement of the present war did not raise the housing standard to any considerable degree, though it began to ease temporarily some of the pressure on the housing market."[2]

What was already an unsatisfactory situation was aggravated by the Second World War. The shortage of materials and manpower led to a fall in the number of dwelling units built. This, coupled with a marked rise in the rate at which new families were formed, accentuated the housing shortage. Measures were taken to provide temporary housing for war workers and veterans and to encourage conversion of old houses into apartment dwellings. But the number of families without separate accommodation of their own increased from 188,000 in 1939 to 311,000 in 1945.[3]

A formidable task thus loomed immediately after the war. The passage of the new National Housing Act of 1944 and the setting up of the Central Mortgage and Housing Corporation in 1946 were the first two steps taken to cope with the situation Through them and the 1954 revision of the National Housing Act, public assistance to housing was further liberalized and institutionalized.

The changing focus of preoccupation with the housing problem over the first postwar decade is described in the annual report of the Central Mortgage and Housing Corporation for 1955.

> "During the past decade the scene changed from year to year presenting new facets of the housing task and offering new problems to be solved. Immediately after the war the shortage of housing had reached a crisis brought about by a rapid increase in marriages and births following upon a long period of limited housing production. First to be considered were returning veterans, many of them with wives from overseas. More than 30,000 rental houses were built by

[2] *Ibid.*, p. 35.
[3] Firestone, O. J., *Residential Real Estate in Canada*, 1949, Table 47, p. 205

> government agency for veterans' families, and veterans were given priority also on more than 20,000 houses built by private enterprise. Another postwar problem was the shortage of supplies. Before industry was fully converted to its peace-time task, housing was held up by lack of supplies of furnaces, bath-tubs and nails; the supply had to be rationed.
>
> "In a later period, as the whole housing programme gathered momentum, the most pressing problems were in winning for housing its share of funds for investment. These difficulties took two forms. On one hand, municipal governments, faced by extraordinary expenditures for schools, traffic arteries and main water and sewage plants, found it difficult to finance the installation of the local services on which houses depend. This difficulty has been partly overcome by incorporating the costs of local services in the prices of houses. The other financial problem has been in securing an even larger source of mortgage funds during a period of massive capital investment in the country's industries and resources."[4]

To obtain a summary impression of the housing problem over the last 30 years, one can do worse than compare rates of family formation and housing production during the period. From 1926 to 1930, housing production exceeded family formation by about 25%. After 1929, housing production and family formation both declined, the former falling faster and longer than the latter, with the result that by 1934 the rates were about equal. Although the two series parted again, housing gained only slightly over net family formation up to 1937. In 1939, family formation caught up with housing and from then until quite recently exceeded it, except in the years 1947, 1949 and 1950. In 1953, 1954 and 1955, however, production of dwellings exceeded family formation by a widening margin.[5]

The quality of the housing stock is probably better today than it was in 1939. A large amount of money was spent on major improvements in the immediate postwar years, and a comparison of the 1951 Census of Housing with the 1941 Census indicates a net amelioration.[6]

As is suggested in the introductory chapter of this study, housing has been an important field of investment in the Canadian economy, and in the last few years its importance has grown. From 1926 to 1948, investment in housing never represented more than 4% of Gross National Expenditure.[7] In the period 1948-1953, investment in housing as a percentage of Gross National Expenditure varied from a high of 4.7% in 1949 to a low of 3.6%

[4] *Tenth Annual Report*, 1955, Central Mortgage and Housing Corporation, p. 8.

[5] Firestone, O. J., *op. cit.*, Table 46, p. 201, and *Canadian Housing Statistics*, 2nd quarter 1956, pp. 9 and 21.

[6] The proportion of total occupied dwellings "in need of major repair" dropped from 26.1% in 1941 to 13.5% in 1951. See *Eighth Census*, Vol. IX, Tables 1 and 3, and *Ninth Census*, Vol. III, Table 16.

[7] Firestone, O. J., *op. cit.*, Table 64, p. 252.

in 1952, with an average of 4.2%. In 1954, housing accounted for 4.8% of Gross National Expenditure, and, in 1955, for 5.6%. Over the postwar period as a whole, housing construction has been a potent factor in maintaining relatively uninterrupted prosperity.

The amount of housing construction which will take place in the next 25 years is not independent of developments in the recent past or of the present housing situation. The foregoing historical notes are intended to provide a starting point from which an assessment of present conditions and of some of the more obvious future needs may be made.

Summary of Housing Forecast

It is estimated in this study that an investment of $43.7 billion will be required over the next 25 years to complete 3.7 million new dwellings and to carry out major improvements on existing houses. This compares with a Central Mortgage and Housing Corporation estimate that an investment of $35 billion will be required to complete 3.4 million new units over the period.[8] Considerable use has been made of the corporation's brief and its supporting calculations. That the dollar figure reached here is higher is largely attributable to the addition of allowances for major improvements and for a rise in the quality of new housing.

The Stock of Housing

The Central Mortgage and Housing Corporation brief reports that there are now more than 3,800,000 occupied dwellings in Canada—about 750,000 on farms, 2,250,000 in cities and towns, and 750,000 in small communities and on the fringes of urban areas.

> "The recent production of housing has followed the general shift of population from farms to cities, from rural communities to metropolitan areas and from central urban areas to suburbs. The oldest part of the housing is therefore on farms and near the central areas of cities. The newest part of the stock, largely but not entirely of good quality, is in the suburban areas of cities and towns. . . . In 1951 about 20% of rural and 9% of urban dwellings in Canada were in need of major repair. . . . The greater part of deficient housing within built-up areas is concentrated around the inner core of cities and awaits a process of urban redevelopment."[9]

The brief points out that about 350,000 units are now more than 75 years old and that more than 500,000 are from 50 to 75 years old. By 1980, it is estimated, the housing stock will consist of 3,500,000 dwelling units up

[8] *Housing and Urban Growth in Canada*, a brief presented to the Royal Commission by the Central Mortgage and Housing Corporation, Ottawa, 1956.

[9] C.M.H.C. brief, p. 9.

to 25 years old, 1,500,000 dwelling units between 25 and 50 years old and 2,300,000 dwelling units more than 50 years old.[10]

Demand Factors

Residential construction activity is determined by the effective demand arising from (1) population growth (formation of new family and non-family households); (2) the reduction of crowding; (3) replacements; (4) shifts of population, notably from rural to urban areas, and (5) changes in the vacancy rate.

Population Growth

Net family formation[11]

Net family formation, in any given year, is defined as the number of families existing at the end of the year minus the number of families existing at the beginning of the year. It represents the most important source of new demand for housing.

For the purpose of forecasting housing investment, it is desirable to have estimates of net family formation, not only for the 25-year forecast period as a whole, but for the 5-year periods ending in 1960, 1965, 1970, 1975, and 1980. The procedure followed consists of deriving from the Royal Commission's basic population forecast an estimate of the number of families likely to be in existence at each of the above dates. The desired estimates of net family formation may then be obtained by subtraction.

Some details of the procedure may be of interest. The Royal Commission's basic forecast provides figures of population classified as to age and sex, but not as to marital status, for the beginning and end of each of the aforementioned quinquennia. An estimate of the population of Canada classified as to age, sex and marital status is, however, available for 1955. Starting with this, therefore, and using the age/sex classification of the Royal Commission's forecast as the primary guide, one must undertake to estimate what will happen to the marital status of the people in each age/sex sub-group during the course of successive quinquennia. Some single people will marry; others will die. Their numbers must be estimated, as must the numbers of married people who die or become widowed or divorced. Mortality rates for different marital status groups are assumed to change in relatively the same way as those used in the basic population forecast. Marriage rates for single, widowed and divorced people are assumed to follow in the future the trends shown since 1921.

[10] *Ibid.*, p. 31.

[11] A family is here defined as in the 1951 Census: "A husband and wife (with or without children) or a parent with an unmarried child (or children) living together in the same dwelling". (*Ninth Census of Canada*, Vol. III.)

In this fashion, it is possible to obtain an estimate of population classified as to age, sex and marital status at the end of each quinquennium. It remains to calculate the number of family heads and hence the number of families. This is done by assuming that the 1951 proportion of persons in each marital status group reported as family heads will be maintained. (These proportions have been constant for the last three decades.)

It is assumed, incidentally, that marriage and mortality rates among immigrants in a given age/marital-status group will be the same as the rates for the rest of the population.

The upshot of the calculations is that the number of families is expected to increase almost as fast as the total population. By 1980, there may be 6,250,000 families[12]—2,550,000 or 69% more than in 1955. Over the same period, the total population is expected to increase by 71.1%. For the next five or ten years, the rate of increase in the number of families may be a good deal lower than the rate of increase in the total population, owing to the fact that the persons most likely to be marrying will be the children of the depression and early war years—periods of comparatively low birth rates. Between 1955 and 1960, the number of families may increase by as little as 9%, compared with a 12% increase in the total population. But between 1965 and 1970 the number of families may increase by 11% compared with a 10.9% increase in the total population; and between 1975 and 1980, the rates may be: families, +12%; population, +11.1%.

If it is assumed that each newly formed family will move into a home of its own—either a new one or an old one vacated by somebody else—then 2,500,000 new housing units must be allowed for on this account alone.

Non-family household formation

In addition to demand for housing arising from the growing number of families, demand will arise from the growth in the number of non-family households. These comprise individuals or groups of individuals who do not fall within the census definition of a family[13] but who nevertheless occupy dwellings.

If it is assumed that persons in families will continue to account for 87% of the population as in 1951, then it may be calculated that 23,185,500 persons will be living in families in 1980. This would leave 3,464,500 persons "not in families", some of whom would be living in non-family households. It is estimated that in 1955 there were 1,946,600 persons not in family groups and 463,100 non-family households[14] for a percentage of 24. If the same percentage prevails in 1980, there should be at that time some 831,500 non-family households—roughly 370,000 more than in 1955.

[12]See C.M.H.C. brief, p. 10.
[13]See note 11.
[14]C.M.H.C. estimate.

(Non-family households do not include individuals living in places such as hotels, convents, hospitals, orphanages, hospices, jails, military camps, etc.)

Total Demand Arising from Population Growth

An addition of some 2,920,000 housing units should thus be sufficient to meet demand arising from net family household formation (2,550,000 units) and from non-family household formation (370,000 units).

Reduction of Crowding

Two kinds of crowding may be distinguished. A household may simply be too large for the number of rooms it occupies. Doubling-up or sharing of accommodation is also deemed to represent crowding, since it is rarely completely voluntary.

It is difficult to arrive at a measure of the first kind of crowding because housing statistics include both dwellings which are crowded and those in which space is not fully utilized. Over the next 25 years some adjustment may be made in this aspect of the housing situation, with large, cramped families moving into more spacious quarters and people who have more room than they wish moving into smaller apartments or houses. The size of the average Canadian family is not expected to increase over the forecast period.

Doubling-up may be more difficult to remedy. It is estimated that in 1955 some 350,000 families were living in the dwellings of other families or living as part of a household the head of which did not belong to the family.[15]

> "For the most part, families not maintaining their own household are in this situation, not because they do not want separate accommodation but because they cannot afford it. Voluntary sharing of accommodation does no doubt occur, but infrequently. The proportion of families not maintaining their own household declines sharply as incomes rise. In 1951, 90% of all families had their own dwelling unit, as compared with over 99% of families with incomes over $6,000 per annum.
>
> "The proportion of families sharing accommodation is likely to decrease in the next 25 years. At best this kind of crowding could be eliminated altogether, although not without deliberate public action toward that end. Whatever happens to incomes and to building costs, there will still be sizable numbers of families in 1980 who cannot afford separate accommodation. At worst, such families could be as

high as 600,000 in 1980. This number represents their present relative incidence applied to the 1980 population and in absolute terms is 250,000 higher than the present figure."[15]

If there is a substantial rise in real average personal income over the next 25 years, the number of families sharing accommodation may be expected to decrease. If incomes become more evenly distributed than at present, the extent of shared accommodation will be still further reduced.

"Any absolute shortage of housing tends to bear particularly heavily on low-income households . . . The greater part of the doubling-up occurs amongst low-income families, and most of the dwellings in need of major repair and lacking essential sanitary facilities are occupied by low-income families."[16]

This suggests that many—perhaps most—of the doubled-up families occupy sub-standard housing. If the number of low-income families increases, housing which under conditions of greater equality in income distribution would be destroyed continues to be occupied. In the final analysis, the problems of shared accommodation and of slum clearance and replacement of sub-standard housing are not a little associated.

The combination of rising incomes and the free play of the housing market may in time do much to reduce crowding. If it is desired to speed up the process however, public intervention, on a larger scale than in the past, will be required.

"The experience of the last seven years and the current attitudes to public housing do not lead to the conclusion that public ownership will form an important part of the landlord sector. There is little demand at the local level for a substantial increase in public housing —perhaps because such a large percentage of the population is reasonably comfortably housed. It may be, however, that a larger volume of public housing will result from the economic and social desirability of this type of construction. We may see substantial quantities of public housing to create employment and, as a by-product, to improve social conditions."[17]

It may not be too optimistic to expect that no net additional doubling-up, except on a voluntary basis, will occur in the forecast period and that a substantial part of the doubling-up that now exists will disappear. To meet this demand about 250,000 additional units, or 10,000 units a year, may be required in the next 25 years.

[15]C.M.H.C. brief, p. 10.
[16]*Ibid.*, p. 24.
[17]*Brief of the Canadian Federation of Mayors and Municipalities*, p. C-12.

Replacements

Some of the new housing which will be built in the next 25 years will not represent a net addition to the total housing stock, but will serve to replace housing which for one reason or another passes out of use. In recent years, such "losses to the stock" are believed to have averaged about 8,000 units annually, with farm and non-farm housing accounting for roughly equal shares of the total.

Many of the so-called farm losses are associated with the decline in rural farm population. Losses of this kind are considered in the following section. The present section deals with all other kinds of losses—those which occur, for example, as a consequence of fire, accident, flood, aging and changes in land use.

On the subject of non-farm losses, the Central Mortgage and Housing Corporation comments:

> "Non-farm losses are not likely to fall below the present level of 4,000 per year. The loss of dwellings through transition in land uses is almost certain to remain as high as at present, particularly in view of the demands likely to be placed on land for traffic articulation and the expansion of other non-residential functions in the built-up areas of our cities. While fire protection techniques will no doubt improve over the next 25 years, the exposure to fire loss will also increase. . . .
>
> "There is no theoretical upper limit to the rate of non-farm losses. Given a sufficient rate of new house building, over and above the needs of population growth, the poorer dwellings in the stock would become unmarketable as dwelling space. As permanently vacant accommodation they would no doubt revert to the public in due course for tax default or be sold to private interests to make way for new land uses. In either case they would eventually be demolished. But the demolition would follow their effective removal from the useful housing stock and not bring it about. The accumulation of vacant dwellings, provided they are confined to the dwellings of the poorest quality in the stock, need not inhibit the demand for new housing. Consequently, any upper limit to the rate of dwelling unit withdrawals from the housing stock over the next 25 years depends on the upper limit of new house-building possibilities."[18]

On the assumption that over the next 25 years the housing market will be less tight, on balance, than it has been over the last decade and a half, it would not seem unreasonable to allow for a fairly considerable increase in the rate of non-farm losses. Up to the present, relatively few urban houses are believed to have been abandoned merely because they were old

[18] C.M.H.C. brief, p. 11.

and decrepit. The housing market has been tight enough, and some people's incomes have been low enough, that even very poor dwellings have not gone begging for occupants. The majority of units lost to the stock either burned down or were torn down because somebody wanted the land for something else. But, given conditions of prosperity and a high rate of new house-building, one would think that the advancing age of a large portion of the present stock must in time begin to have an increasing effect, perhaps in the form of a more vociferous demand for slum clearance.

Attempts have been made on various occasions to estimate the number of housing units which *should* be replaced. In 1944, the Curtis Committee estimated that up to 175,000 units would be required for the replacement of sub-standard housing.[19] With total losses running at 8,000 a year, much of the housing which the committee had in mind to replace must still be in service today, although some of it may have been improved.

The municipality of Metropolitan Toronto estimates that its needs for replacements by 1980 will include, as a bare minimum, 140,000 units located in areas which had been almost completely built up by 1914. These units will be at least 65 years old by 1980 and the majority may well be more than 100 years old. (Some 16,000 units which, in 1951, required major structural repairs, and 18,000 or 19,000 units which were deficient in private sanitary facilities, are included in this group.) To these should be added at least some of the 75,000 units which are located in areas built up between 1914 and 1939. The majority of these units would be between 40 and 65 years old in 1980.[20]

> "New construction in the area is effectively beyond the reach of most of the area's families on either a rental or purchase basis. Most have to rely, for purchase or rent, on the existing supply of old houses; however, as long as only a relatively limited market exists for new construction, the supply of older housing must perforce be a constricted one. This is particularly pertinent insofar as the replacement segment of the housing market is concerned—a segment which will become increasingly important in time and which, over the 25-year period, may be expected to account for perhaps one third of the total requirements. If the housing industry can supply new housing for a fraction of the total population only, necessary replacement must be postponed and occupancy continued considerably beyond the normal life of many dwellings.
>
> "More than half of the Toronto area's increase in population regularly stems from the movement of overseas immigrants into the area. Typically, immigrant families settle, at least initially, in the

[19] *Report of the Advisory Committee on Reconstruction*, Vol. IV, "Housing and Community Planning", Ottawa, 1944, p. 143.

[20] *Brief of the Municipality of Metropolitan Toronto*, pp. 154-155.

older sections of the city, where the supply of new housing is qualitatively most inadequate. This may be seen by occupancy statistics relating to conditions that existed in 1951, which have probably changed little since that date. At that time it was found that 42% of all dwelling units in the city occupied by postwar immigrant families contained doubled-up families, as against 20% for non-immigrant families. Half the immigrant-occupied dwellings had lodgers, as against 30% for non-immigrant units. Forty-one percent of the immigrant dwellings were considered overcrowded (more than one person per room), as against 12% of the non-immigrant units.

"Probably at least 10%, and possibly as much as 20%, of the 460,000 units which the area will require in the next 25 years, should be in some form of publicly aided housing."[21]

Although the City of Montreal does not go into as much detail, replacement needs there will doubtless be considerable. The city's brief estimates the number of inadequate dwellings at 25,000 on the basis of a 1954 survey.[22] No other estimate of future requirements is given.

It must be remembered that houses built before the First World War will reach what is, by North American standards, a distinctly advanced age during the period contemplated. In 1955, 350,000 housing units in Canada were over 75 years old, and more than 500,000 units were between 50 and 75 years old. Seventy-five years has been quoted as a life expectancy for the average non-farm house.[23] By 1980, about one million units, some of them, of course, farm houses, will have passed that point.

Past experience cautions one against assuming that actual replacement during the period will be of anything like this order. But perhaps, all things considered, including the probability of major changes in urban land use and the prospective growth of income, a total of 330,000 units is a conservative enough allowance for the kind of replacement dealt with here.

Replacements Occasioned by Shifts of Population

Between 1941 and 1951 the number of farms in Canada decreased by about 100,000. It is expected that the farm population will continue to show a large net decline until perhaps 1965, and that many farm houses will be vacated by people moving away to towns and cities. In most cases these abandoned farm houses will probably be left to deteriorate, the land having been bought by nearby farmers whose own homes are of better quality than those which have been abandoned. Most of them will have to be regarded as no longer part of the useful stock of housing.

[21] *Ibid.*, pp. 160-163.
[22] City of Montreal brief, p. 4.
[23] Firestone, O. J., *Residential Real Estate in Canada*, p. 427.

In view of the net decline in the rural farm population forecast in Chapter 2 of this study and the decline in the number of farms anticipated in the Royal Commission's agricultural study,[24] it seems reasonable to expect a drop in the number of farms between 1951 and 1980 of 80,000 to 90,000. Much of this decline may have taken place already. It is assumed here that urban construction attributable to in-migration from farms will be about 50,000 units between 1955 and 1980.

There are other kinds of migration which can create a need for new housing.Some sound and usable housing may be abandoned as people move from small fishing villages, for example, to larger ports, or from towns based on declining industries to towns and cities with better prospects. Migration of this sort is particularly difficult to forecast, and no special allowance is made for it here. The omission is not likely to be a serious one in relation to total housing demand.

Vacancies

Even in periods of acute housing shortage, some part of the useful housing stock will at any given time be vacant, awaiting tenants or purchasers. In 1955, out of a total useful stock of 3,913,000 units, some 98,000, or 2.5% were vacant.[25] For the last several years, the rate has been in the neighbourhood of 2.6%.[25] By comparison with some past periods, this may be considered low: in 1928-29, for example, the rate was 4%.[26]

Calculations so far have indicated a need for 3,550,000 additional housing units over the forecast period. Of these, 380,000 would represent replacements; the remaining 3,170,000, when added to the present useful stock of 3,913,000, would bring the estimated 1980 stock to 7,083,000.

With a larger stock, one would expect a larger absolute number of vacancies. The vacancy *rate*, too, could well be higher in 1980 than it was in 1955; the assumption here is that it will be 3.3%. To allow for this, the forecast of the 1980 housing stock is raised to 7,324,716 units, and the forecast of additional requirements is raised to 3,693,716.[27]

Estimated Housing Requirements

It thus appears, subject to the numerous assumptions described above, that something in the neighbourhood of 3,700,000 new housing units—almost as many as exist today—may be required over the forecast period. In Table 10, an effort is made to allot the total to quinquennia. As elsewhere in the study, the resulting distribution should not be taken too seriously. The

[24]See Drummond, W. M., and Mackenzie, W., *Progress and Prospects of Canadian Agriculture.*

[25]C.M.H.C. estimate.

[26]Firestone, O. J., *op. cit.*, p. 51.

[27]For the remainder of the chapter with the exception of Table 10, this figure is rounded to 3,700,000 units.

Table 10

ESTIMATED HOUSING CONSTRUCTION REQUIREMENTS, 1956-80

(thousands of units)

Allowances for:	Population growth		Other factors				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Period	Net family formation	Non-family household formation	Reduction of crowding	Replacements other than those allowed for in (5)	Replacements occurring as a result of population movement from farm to urban areas	Vacancies	Total
1956-60	348	66	50	50	25	20	559
1961-65	414	67	50	58	20	24	633
1966-70	500	70	50	66	5	29	720
1971-75	605	78	50	74	—	33	840
1976-80	683	89	50	82	—	38	942
Total	2,550	370	250	330	50	144	3,694

allotment of requirements arising from net family formation has, perhaps, some pretensions to science; but in the other columns of the table, as the figures themselves suggest, the procedure followed is highly arbitrary. Notwithstanding all that has been said about the, so-to-speak, subsidiary sources of housing demand, the two most important influences on the rate of total housing completions at any time in the foreseeable future are likely, as a matter of practical fact, to be the rate of family formation and general economic conditions. What is put forward here is that, if economic conditions are, by and large, good, and if the Royal Commission's expectations regarding the growth of population and incomes are broadly fulfilled, the number of housing completions over the entire 25-year period may be of the order suggested.

Investment in Housing

It remains to convert the forecast of housing requirements into a dollar investment figure, to give some consideration to such matters as the type, quality and location of new construction, and to make allowance for major improvements to the housing stock.

Type, Location and Cost of Construction

The average unit cost of new housing seems to vary, not only with the kind of unit built (single-family detached houses, semi-detached houses, apartments, etc.), but also with whether it is farm or non-farm housing. In Table 11, an attempt is made to cross-classify the forecast of total requirements according to type and location of construction.

Table 11

DISTRIBUTION OF NEW DWELLING COMPLETIONS, 1956-80

(thousands of units)

Location	Single	Multiple (apartments, duplexes, etc.)	Conversions	Total
Urban	2,238	1,053	100	3,391
Rural non-farm	193	16	—	209
Farm (largely replacements)	100	—	—	100
Total	2,531	1,069	100	3,700

The distribution of non-farm completions between urban and rural non-farm areas is based on the urban-rural population forecast of Chapter 2. This may be questioned on the grounds that the oldest part of the present Canadian housing stock is for the most part on farms or in the central areas of cities, and that the non-farm replacement demand is therefore likely to

be concentrated almost entirely in urban areas. But since the necessary adjustment would be a small one, and since the forecast of rural non-farm population is so very tenuous in any case, it hardly seems worth while to make the change.

It is assumed that completions of multiple housing units (apartments, duplexes, etc.) will bear roughly the same relationship to total non-farm completions as they did in 1952-54—i.e. 32% in urban areas, and 7.8% in rural non-farm areas.[28] It may be mentioned that the proportion of multiple completions to total completions (including farm completions) was nearly 50% in the period 1936-40. It dropped away to 20% in the period 1946-50, but rose again to 25% in 1951-55.[29] Rises and falls in relative preferences for single and multiple housing would seem to be governed by a complex of factors—some economic, some sociological—whose action in the future is extremely difficult to forecast.

It would appear that, on the whole, the cost of building an urban house of a given size and quality does not vary a great deal from one major economic region of Canada to another. There are, indeed, noticeable variations in the average wages of construction workers, but in regions where wages are relatively low, transportation costs, and thus material costs, often happen to be relatively high. Recent experience also indicates that the costs of building detached houses in urban and rural non-farm areas tend to be roughly similar.

There does, however, appear to be a considerable difference between the cost of building farm houses and that of building single-family houses in cities and other non-farming areas (although here, of course, quality comparisons are difficult to make). Estimates made available by the Central Mortgage and Housing Corporation indicate that the average unit value of non-farm, single-family houses constructed under the Corporation's auspices in 1955 was $11,373. The unit value of farm houses similarly constructed was only $4,553. Multiple dwellings in non-farm areas are estimated to have cost an average of $8,773 each, and conversions averaged $3,710 per new unit created. (The figures include the cost of equipment permanently attached to houses, such as furnaces and plumbing. They do not, of course, include the cost of land or of any municipal services.)

By the use of these estimates, the forecast of housing requirements may be converted into a dollar forecast of gross new housing investment, as in Table 12.

[28] Based on C.M.H.C. estimates.
[29] C.M.H.C. estimates.

Table 12

DISTRIBUTION OF INVESTMENT IN NEW DWELLINGS, 1956-80

(millions of dollars)

Area	Single	Multiple	Total	Conversions	Total
Urban	25,453	9,238	34,691	370	35,061
Rural non-farm	2,195	140	2,335	—	2,335
Farm	450	—	450	—	450
Total	28,098	9,378	37,476	370	37,846

The Quality of Housing; the House-Building Industry

As it stands, the forecast just given assumes that the average cost of new housing, expressed in 1955 dollars, will not change. One may usefully consider whether such an assumption is a wise one. As incomes and living standards rise, prospective purchasers of new housing may come to demand a higher quality product and to be willing to pay more for it. On the other hand, technological and other improvements in the house-building industry may enable that industry to achieve a significant increase in the average quality of its output with little or no increase in average price.

The Central Mortgage and Housing brief comments that there are likely to be changes of fashion in housing, such as the recent swing to split-level houses. Improvements are predicted in the mechanical equipment built into housing—in heating and plumbing systems, for example. A progressive raising of space and other amenity standards may be expected. There will be advances in methods of design, fabrication and assembly which will provide more and better space without increasing cost.[30]

> "Because of the great demand for accomodation during the last decade, the house-building industry has not been under strong competitive pressure to diversify the range of its products or to advance the quality of their design. In these circumstances the bulk of new housing has been of somewhat stereotyped form, lacking the variety and refinement which is stimulated in a period of strong competition. "It may be expected that during the coming years the house-building industry will be presented with both a challenge and an opportunity to extend the diversity and improve the quality of its products. The increasing capacity of the industry to produce in quantity may well bring about a shift from a sellers' to a buyers' market."[31]

Housebuilders will be under more competitive pressure to win customers. Some builders may develop improved lower-priced accommodation in the form of row-housing and small apartments. Others may specialize in large houses costing $25,000 or more. Home-owners with growing families may

[30] C.M.H.C. brief, p. 17.
[31] *Ibid.*, p. 23.

seek larger accommodation. Young people may seek rental accommodation allowing them greater freedom and mobility of employment. Old people may look for smaller quarters with janitor service. The housing industry should be able to respond to these various requirements, aided by national housing legislation and supported by local planning.

> "Prospective trends in the supply of new housing over the next 25 years are even more favourable. In the past ten years the house-building industry has doubled its output with little change in real construction costs. Prospects for new house-building over the next two decades and a half are such as to suggest that the present industry, with virtually no expansion, could meet the task. Canadians completed 131,000 houses in 1955. At this rate and with this industry, over three million units could be produced in 25 years. Cost pressures associated with the expansion of capacity should be very moderate in the period up to 1980. Housebuilders are in the position of being able to increase their profits only through lowering real costs or improving the appeal of their products."[32]

The brief deals with some of the advances the industry has made in the past and outlines some which may be expected in the future.

> "Since 1946 the housing industry has doubled its capacity. Few of the present house-building organizations had previous experience, and a new generation of tradesmen had to be trained on the job. The industry has now gained a considerable expertise, largely in the production and merchandising of small single-family houses. . . .
>
> "Traditional methods of frame-building have been followed, and economies have been sought not through new structural systems, but through bulk-purchasing of supplies and the more efficient staging of the building process. The jack-of-all trades builder-carpenter has been displaced by specialized crews. . . .
>
> "There has also been a speeding-up of production through the use of mechanized equipment for handling materials, for excavating, for cutting and assembling. Power tools have replaced the traditional contents of the carpenter's kit. . . .
>
> "Significant advances in building technique appear to be associated with the shifting of more operations from the site to the workshop. Building components may be designed so that they can be finished by machine tools under factory conditions, shipped to the site and assembled rapidly. . . . Experience has shown that the degree of prefabrication depends upon the size and geographical accessibility of an assured market, to justify the investment in plant, machine tools

[32] *Ibid.*, p. 12.

and merchandising. Such conditions are more likely to be present during the coming years in Canada that they have been in the past.

> "In order that housing may benefit from the process of industrialization, it is necessary that the industry itself should plough back more of its profits into research, development and design. . . . The Canadian house-building industry, as such, is only now beginning to accept the challenge facing it in a new period of large potential markets. . . . There is an immediate need to use to greater advantage the present materials and methods of building. Housebuilders have not made full use of the architectural services available in the country. . . . The housing industry has been too willing to settle for conformity with minimum standards and poorly executed architectural convention and design."[33]

There are good reasons for expecting that a higher quality of new housing will come to be demanded. The question is: *To what extent can that higher quality be provided without an increase in average unit cost?* It has here been decided, partly on the basis of certain calculations contained in the Royal Commission's consumption study,[34] that an advance of 7% in average unit cost may be a reasonable allowance for the expected improvement in quality, or rather for that part of the improvement which cannot be offset by increases in the efficiency of the house-building industry. The figure of $37.8 billion for gross new investment in housing is therefore raised to $40.5 billion.

Major Improvements to Housing Stock

Major improvements are defined for the purpose of this study as "structural alterations and improvements to residential building for which building permits are required, excluding those alterations which result in the addition of a new dwelling."[35] This definition may give rise to some underestimation, owing to the exclusion of improvements which do not require a building permit. However, this is compensated for, to some extent, by the fact that some improvements of a strictly repair nature *are* included.

Immediately after the war the percentage of housing investment that went into major improvements was very high, but in recent years it has dropped to about 8% of new construction and conversion expenditures. On the assumption that this rate will continue to prevail during the next 25 years, investment in major improvements is here estimated at $3.2 billion, and this brings the grand total of gross new investment in housing to $43.7 billion.

[33] *Ibid.*, pp. 17-18.
[34] See Slater, D. W., *Consumption Expenditures in Canada*, Chapter IV, Section 6.
[35] C.M.H.C. definition.

Table 13

TOTAL ESTIMATED RESIDENTIAL INVESTMENT

(millions of dollars)

1956-60	6,600
1961-65	7,400
1966-70	8,400
1971-75	10,000
1976-80	11,300
Total	43,700

Conclusion

One further quotation from the Central Mortgage and Housing Corporation's brief to the Royal Commission may serve as a conclusion:

> "These data suggest that the urban housing stock is likely to double over the next 25 years with an impact on cities of all sizes, although not necessarily on every city. This housing represents a major part, but only a part, of the whole fabric of urban growth. The construction put in place in the next generation will represent half of our urban environment in 1980. Much of its worth at that time will depend on the care and imagination with which it is installed in the first place. Cities, as producing centres and as end product, represent our greatest single asset. The quality of their transformation in the next generation poses our greatest single problem."[36]

[36]C.M.H.C. brief, pp. 14-15.

4

HOSPITALS

THERE HAVE BEEN hospitals in Canada since the earliest days of settlement. The first was the Hôtel Dieu of Quebec, opened in 1639. Other early hospitals were founded as shelters for the aged, the infirm, orphans, vagrants and the maimed, as isolation centres for the dangerously insane and persons suffering from communicable diseases, and as emergency quarters for wounded and sick soldiers, sailors and marines in wartime.

During the latter part of the nineteenth century, the functions of hospitals changed radically. Where these institutions had merely supplied food, shelter and meagre medical care to special groups, they now came to provide skilled medical and surgical attention and nursing care to all elements of the population. Numerous new medical and surgical techniques required costly equipment and trained personnel, which only hospitals could provide. Patients became more inclined to seek hospitalization because circumstances in many homes, such as overcrowding, combined with a shortage of suitable trained help, made home nursing care impracticable.[1]

Today demand and need for hospital care are affected by many factors. Some of these are the size, density and age distribution of the population, birth and death rates, the prevalence of sickness, methods of treament, the average length of stay in hospital, the changing practices of medical practitioners and patients in regard to hospital utilization, the availability of health personnel, and such personal and economic factors as arrangements for meeting the costs of care.

These change with time, and it is impossible to project trends for all variables. For instance, if a cure were discovered for a prevalent disease such as cancer, the demand for beds could lessen to a considerable degree. Methods of treatment within mental hospitals are changing. New forms of therapy are improving the outlook for many patients and the average length

[1]For a complete account of the development of Canadian hospital services see *Hospitals in Canada*, General Series Memorandum No. 10, Research Division, Department of National Health and Welfare, Ottawa, September 1955.

of stay is declining. On the other hand, new emphasis on active treatment of mental cases has encouraged early hospitalization for many patients who might not have been treated at all a few years ago. Also, the proportionate rise in the older age-group in the population tends to increase the need for care, particularly in chronic units or hospitals. An offsetting trend is the marked decrease in the incidence of communicable diseases which affect chiefly the younger age-group. Because of the number and complexity of the factors which influence hospital need, medical and health authorities,[2] desirous of establishing what the total need is, generally content themselves with a broad measure and express hospital requirements in terms of a "bed standard". Thus they say that for every 1,000 of population there should be a certain number of beds available. By this they mean, of course, that there should be a certain number of beds, with an appropriate complement of buildings and equipment.

Present day hospitals not only provide for the sick but also serve as training grounds and clinical research laboratories for medical personnel. Out-patient services extend hospital benefits to the community at large. Under these circumstances it would seem reasonable to assume that the demand for hospital services—and thus for hospital facilities—will continue to grow at least in proportion to the increase in population. By the application of bed standards to the population forecast, and by the use of some assumptions and methods described later on, it is estimated that over the next 25 years capital expenditures of $2.4 billion, expressed in 1955 dollars, will be required to provide 91,100 active treatment hospital beds, 30,700 chronic and convalescent hospital beds and 77,400 mental hospital beds in addition to present capacity and to meet, as well, the needs of federal government hospitals. Capital expenditures on equipment will probably amount to an additional $335 million. A description of the assumptions and methods used in estimating capital requirements for each type of hospital follows.

Active Treatment and Chronic Hospital Beds

In the United States, the Hospital Survey and Construction Act sets forth certain limits beyond which federal aid to hospitals is not available. For general and chronic disease hospitals, these limits are set at 4.5 to 5.5 general beds and two chronic disease beds per 1,000 population. These standards were developed in 1945 and have not been revised. It has been said that the 4.5 figure is "admittedly a compromise between a theoretical ideal and a practical achievement";[3] and with regard to chronic beds "the measure of need

[2] *How Many General Hospital Beds are Needed?* U.S. Public Health Service Publication 309, 1953. *Hospitals in Canada,* General Series Memorandum No. 10, Research Division, Department of National Health and Welfare, Ottawa, September 1955.

[3] Mountin, Joseph W., Pennell, Elliot H., and Hoge, Vane M., *Health Service Areas: Requirements for General Hospitals and Health Centres,* Public Health Service, Bulletin No. 292, Washington, U.S. Government Printing Office, 1945, pp. 4-7.

for chronic disease beds has not yet been established".[4] Recent committees of inquiry have emphasized the need for a thorough review of United States federal bed standards.

The findings of provincial health survey committees, which in 1948 attempted to estimate active treatment and chronic bed requirements per thousand of population, were as follows:

Table 14

ACTIVE TREATMENT AND CHRONIC HOSPITAL BED REQUIREMENTS, 1948

(per thousand population)

	Active treatment	Chronic	Total
Newfoundland	5.0	a	a
Prince Edward Island	a	a	a
Nova Scotia	5.0	2.0	7.0
New Brunswick	4.6	2.0	6.6
Quebec	5.0	2.0	7.0
Ontario	5.0	1.5	6.5
Manitoba	5.7	a	a
Saskatchewan	7.5	a	a
Alberta	7.0	a	a
British Columbia	6.7	a	a

a No requirements stated.

Additional special estimates prepared by the Research Division of the Department of National Health and Welfare[5] for provinces which had not developed standards for both active treatment and chronic beds, combined with the committees' findings, suggest that a composite average for Canada as a whole would be 5.5 acute beds per 1,000 population and 1.5 chronic beds per 1,000 population. An estimate of actual bed capacity and bed population ratios for the year 1956 indicates that 5.7 beds per 1,000 population would be available, compared to seven per 1,000 suggested by the ratios of 5.5 acute and 1.5 chronic beds per 1,000. (See Table 16.)

In estimating capital requirements for the 25-year period, it is assumed that during that time all provinces will reach the current composite standard of 5.5 active treatment beds per 1,000 population and 1.5 chronic beds per 1,000 population. This seems reasonable, particularly if circumstances are such that the use of hospitals is not limited by the financial position of the patient. Saskatchewan will require seven beds per 1,000 in active treatment hospitals to provide a rate equivalent to that which it is giving today. Alberta and British Columbia will require about six beds per 1,000 in such hospitals to provide an equivalent rate. Chronic patients may be treated in chronic units or hospitals rather than in active treatment beds. This, together with

[4]Senate Committee on Education and Labor, hearings on S.191, 79th Congress, First Session, 1945, p. 95.

[5]*Hospitals in Canada*, General Series Memorandum No. 10, Research Division, Department of National Health and Welfare, Ottawa, September 1955, pp. 42-57.

the increasing number of older persons in the population, means the need for chronic hospital facilities will increase to at least 1.5 chronic beds per 1,000 as a minimum standard, although some provinces have few chronic beds today. This would mean construction of 68,200 active treatment beds to meet increased population demands, as well as 22,900 active treatment beds for replacement and 30,700 chronic and convalescent beds, or a total of 121,800 beds. (See Tables 15 and 17.) It is assumed that there will be no additional replacement of active treatment beds provided since 1948 and practically no replacement of chronic beds since these numbered only about 6,000 in 1948.

Table 15

ESTIMATED TOTAL BED REQUIREMENTS, 1980

	Pop. est. (thousands)	Active treatment		Chronic-convalescent			
		Total beds	Beds per 1,000 population	Total beds	Beds per 1,000 population	Total beds	Beds per 1,000 population
Atlantic Provinces	2,360	13,000	5.5	3,500	1.5	16,500	7.0
Quebec	8,010	44,000	5.5	12,000	1.5	56,000	7.0
Ontario	9,620	52,900	5.5	14,400	1.5	67,300	7.0
Manitoba	1,220	6,700	5.5	1,800	1.5	8,500	7.0
Saskatchewan	1,150	8,100	7.0	1,700	1.5	9,800	8.5
Alberta	1,770	10,600	6.0	2,700	1.5	13,300	7.5
British Columbia	2,520	15,100	6.0	3,800	1.5	18,900	7.5
Canada	26,650	150,400		39,900		190,300	

Table 16

1956 ESTIMATED BED CAPACITY AND BED-POPULATION RATIOS

	Active treatment[a]		Chronic-convalescent[b]		All	
	Total beds	Beds per 1,000 population	Total beds	Beds per 1,000 population	Total beds	Beds per 1,000 population
Newfoundland	1,739	4.1	—	—	1,739	4.1
Prince Edward Island	635	5.9	—	—	635	5.9
Nova Scotia	3,311	4.8	157	0.2	3,468	5.0
New Brunswick	2,421	4.3	89	0.1	2,510	4.4
Quebec	21,955	4.7	3,690	0.8	25,645	5.5
Ontario	26,463	5.0	3,837	0.7	30,300	5.7
Manitoba	4,738	5.5	412	0.5	5,150	6.0
Saskatchewan	6,362	7.0	n.a.	n.a.	6,362	7.0
Alberta	7,225	6.5	253	0.2	7,478	6.7
British Columbia	7,300	5.4	800	0.6	8,100	6.0
Total	82,149	5.1	9,238	0.6	91,387	5.7

a Rated bed capacity except in Newfoundland and Quebec where beds set up have been used; includes chronic and convalescent beds and psychiatric units in active treatment hospitals but excludes tuberculosis units. Rated bed capacity means the number of beds in a hospital as established by provincial hospital standards or by defined minimum floor areas where the provincial standards are less than the minimum. (See *Handbook of Definitions and Instructions for Completing Hospital Reporting Schedules*, Dominion Bureau of Statistics.)

b Beds set up, i.e. the number of beds actually set up for the accommodation of in-patients at a given time.

n.a. No estimate available.

Table 17

ESTIMATED CONSTRUCTION REQUIREMENTS, 1956-80

(to meet existing shortages and population increases and to provide beds to replace obsolete facilities)

	Active treatment				
	New beds	Replacement beds[a]	Total	Chronic and convalescent	Total
Atlantic Provinces	4,900	2,300	7,200	3,300	10,500
Quebec	22,000	5,900	27,900	8,300	36,200
Ontario	26,400	7,000	33,400	10,600	44,000
Manitoba	2,000	1,300	3,300	1,400	4,700
Saskatchewan	1,700	2,000	3,700	1,700	5,400
Alberta	3,400	2,000	5,400	2,400	7,800
British Columbia	7,800	2,400	10,200	3,000	13,200
Canada	68,200	22,900	91,100	30,700	121,800

a Based on 5 years replacement rate of 8.5% applied to 1948 rated bed capacity of 53,700.

Mental Hospital Beds

Ratios suggested by the provinces in the 1948 health survey reports varied from 4.0 mental hospital beds per 1,000 population to 5.75 beds per 1,000. Patients actually under care in mental hospitals in 1954 varied from 2.3 to 5.3 per 1,000 population. It is suggested that five beds per 1,000 population might be an appropriate standard for Canada today. This corresponds to the United States standard under the Hill-Burton Hospital Survey and Construction Act: the U.S. Federal Government provides financial assistance for construction of mental hospital beds up to a level of five beds per 1,000 population in any state. So far the pressure on mental hospital facilities has not been reduced substantially. However new treatment methods and the great expansion of preventive and short-term treatment services in community clinics and psychiatric units in general hospitals may eventually reduce the patient load.

If the standard of five beds per 1,000 population is applied to the estimated population in 1980, total bed requirements will be 133,400.

Table 18

ESTIMATED MENTAL HOSPITAL CONSTRUCTION REQUIREMENTS, 1956-80

	Estimated rated bed capacity 1956	Estimated total bed requirements 1980 (5 per 1,000)	Estimated construction requirements 1956-1980
Atlantic Provinces	5,900	11,800	5,900
Quebec	16,900	40,100	23,200
Ontario	16,400	48,100	31,700
Manitoba	3,400	6,100	2,700
Saskatchewan	4,300	5,800	1,500
Alberta	4,000	8,900	4,900
British Columbia	5,100	12,600	7,500
Canada	56,000	133,400	77,400

While rated bed capacity in 1956 was estimated at 56,000, the number of beds set up was much greater. Undoubtedly many existing beds will be replaced in the next 25 years. It is assumed, however, that most replacements will relate to extra beds currently set up, and efforts will be concentrated on reducing bed deficiencies rather than on replacing existing rated bed capacity.

Tuberculosis Sanatoria Beds

Beds set up in tuberculosis sanatoria and tuberculosis units in general hospitals increased from 14,945 in 1948 to 18,962 in 1953. By 1954 the discharge rate was enough to enable most provinces to accommodate all new cases. Indications are that the problem of providing sanatorium beds has been largely solved.

Federal Hospitals

Federal hospitals are operated by the Department of Veterans Affairs, by the Department of National Defence, by the Indian Health Services of the Department of National Health and Welfare, and by the Quarantine, Immigration, Medical and Sick Mariners Services of the same department. They care for groups of persons who, under the British North America Act, are federal responsibilities.

On the assumption that Canada will not be involved in active conflict in the next 25 years, it is estimated that $100 million will cover capital requirements for federal hospitals during the period.

Construction Costs

Hospital construction cost estimates are varied and depend on a number of factors, including location. Large active treatment hospitals which provide special departments for advanced medical care and for teaching facilities are costly to build and operate. The City of Montreal brief sets the cost per bed of a general hospital at $15,000, while a spokesman for the Joint Hospital Campaign in Montreal fixes the cost at $18,000. A scanning of recent press clippings indicates a cost of $16,000 per bed in Quebec City. The *Vancouver Province* assumes a cost of $25,000 a bed for acute hospitals and $10,000 a bed for chronic hospitals. Dr. Lawrence Ranta, assistant director of medicine, Vancouver General Hospital, has said that the cost of building chronic hospitals will not be much lower than that of acute hospitals, as chronic patients require X-rays, laboratories and special branches, just as do acute patients.

The Province of Ontario brief estimates the construction cost of general hospital beds in the period 1956-60 at $11,000 to $14,000, and of chronic beds at $7,500. Its calculation of expenditure on mental hospital beds by

1975 is based on a cost of about $8,300. The brief of the municipality of Metropolitan Toronto fixes the cost of general hospital beds at $12,000 to $15,000 and of chronic beds at $8,000 to $12,000. The City of Ottawa brief puts the average cost of active treatment and chronic/convalescent beds at $8,000. Recent press clippings indicate that present construction costs of general hospital beds in Ontario may average about $13,000.

The brief of the Government of Manitoba sets 1955 capital construction costs at $10,000 each for general and chronic hospital beds and $6,000 for mental beds. Press reports indicate that the average cost of general hospital beds in Manitoba may be about $10,000. The Saskatchewan Government brief estimates the cost of general hospital beds at $15,000 and mental hospital beds at $5,000. The City of Prince Albert fixes general hospital bed costs at $10,000. Nova Scotia, in its memorandum on social capital, uses cost-of-bed estimates as follows: active treatment, $10,000; chronic, $8,000; and mental, $8,000. Newfoundland's brief estimates the cost of a general hospital bed at $10,000 and calculates mental hospital expenditure on a $6,000-per-bed basis. Newspaper reports indicate that the present construction costs of general hospital beds average about $10,000 in Alberta and $13,000 in British Columbia.

Average costs for 1956 are estimated for the purpose of this report at $15,000 for active treatment hospital beds, $10,000 for chronic-convalescent and $8,000 for mental. The average cost of construction of new active treatment beds by year of completion ran from $6,300 in 1949-50 to $13,500 in 1954-55. The following is an estimate of requirements to 1980.

Table 19

ESTIMATED CAPITAL EXPENDITURES ON HOSPITALS, BY REGION, 1956-80

(millions of 1955 dollars)

	Active treatment	Chronic-convalescent	Mental	All
Atlantic Provinces	108	33	47	188
Quebec	418	83	186	687
Ontario	501	106	254	861
Manitoba	50	14	22	86
Saskatchewan	56	17	12	85
Alberta	81	24	39	144
British Columbia	153	30	60	243
Total ex. federal hospitals	1,367	307	620	2,294
Federal Hospitals				100
Total				2,394

The estimates in Table 19 do not include capital expenditures on hospital equipment. Information in the series, *Private and Public Investment in Canada,* indicates that, in the period 1952-55 inclusive, hospital equipment expenditures have varied between 11% and 14.7% of hospital construction, and

for three of the years have exceeded 14%. If 14% is assumed as the ratio for the period 1956-80, hospital equipment expenditures may be estimated at about $335 million.

Estimated Capital Expenditure on Hospitals by Periods

If there were no backlog of need for hospital beds, it would be logical to assume that the spread of capital expenditures for this purpose in the 25-year period would be directly related to population growth. However, notwithstanding the extensive hospital construction programme which has taken place in recent years, a shortage of beds—and more particularly of chronic, convalescent and mental beds—still exists in some areas. Provincial briefs in some instances indicated that a special effort to catch up was likely to be made in the next ten years. In the table below some weight has been given to this factor.

Table 20

ESTIMATED CAPITAL EXPENDITURES ON HOSPITAL BUILDINGS AND EQUIPMENT, BY PERIODS

Period	Millions of 1955 dollars
1956-65	1,090
1966-70	490
1971-75	545
1976-80	604
Total	2,729

5

SCHOOLS AND UNIVERSITIES

IT WOULD BE as well to begin with a reminder that the provision of buildings and equipment—which is all that is dealt with here—is neither the most expensive nor the most important part of education. In recent years, current expenditure on education has been considerably greater than capital expenditure. Looking to the future, one may be fairly certain that the task of obtaining sufficient numbers of well-qualified teachers will prove much more difficult and complex than that of constructing physical facilities.

Buildings and equipment are nevertheless important. Good buildings facilitate good teaching, and the use of equipment as an aid to instruction has grown apace in nearly every branch of education.

Educational buildings have additional value in that they are often suitable for other uses. After hours, they may serve as community meeting places or recreational centres.

Table 21

LIVE BIRTHS IN CANADA, 1921-54

	Thousands of births	Births per 1,000 population
1921-25 Avge.	248	27.4
1926-30 "	237	24.1
1931-35 "	228	21.5
1936-40 "	229	20.5
1941-45 "	277	23.5
1946-50 "	355	27.4
1946	331	27.0
1947	359	28.7
1948	347	27.1
1949	366	27.3
1950	371	27.1
1951	380	27.2
1952	403	27.9
1953	417	28.2
1954	435	28.7

SOURCE: Dominion Bureau of Statistics, *Vital Statistics* (annual).

Since the Second World War, annual investment in school and university facilities has increased faster than any other kind of social capital expenditure. Statistics for the early and late parts of the period are not exactly comparable, but outlay in 1955 would appear to have been roughly six times the 1946 amount.

In a broad, national sense, the postwar school building problem did not begin to arrive until the early 1950's; but then it arrived quite suddenly, as successive contingents of war and postwar babies reached school age. Prior to that time, the low birth rates of the depression years had kept the school population down. Between 1933 and 1944, total enrolment in elementary and secondary schools tended on the whole to decrease, and even when the trend was reversed the rise was at first a slow one. Not until 1948 did the school population begin to increase faster than the national population; and not until 1950 was the enrolment figure of 1933 finally exceeded.[1]

This is not to say that the erection of school buildings which took place between the end of the war and 1950 was unnecessary: old buildings had to be replaced, and shifts of population—from rural areas to urban areas, for example, and from central areas to suburbs—created new requirements in many localities. Then, too, the increase in total enrolment came faster and earlier in some regions than in others. But not until fairly recently was the total Canadian school plant called upon to accommodate more pupils than it ever had before. Now, however, the building of schools must keep pace with what promises to be both a steep and a protracted increase in the aggregate school population.

> ". . . What has been called the 'tide of school enrolments' is not a tide at all, but an ever swelling stream. It has not yet reached its peak; indeed, there is little reason to believe that it will reach a crest and then recede. The flood may rise less violently a few years hence, but there is no reason to expect it to drop back to former levels or even to maintain a steady rate of flow. So far as we can see, it will continue to rise for a very long time. More children are being born in Canadian homes; more of them are surviving beyond infancy to go to school. They are attending school more regularly and are staying at school longer than did their parents or even their elder brothers and sisters. More of them are graduating from secondary school and many more are seeking admission to the universities and other schools of higher learning."[2]

Despite the fact that a large part of the total school and university population of the next eight or ten years is already alive and kicking, the prediction of capital requirements for education is at least as fraught with difficulty

[1]See Appendix I.

[2]Althouse, J. G., "Significant Trends in Education in Ontario", *University of Toronto Quarterly*, January, 1956, p. 232

and uncertainty as other kinds of social capital forecasting. Particularly at the secondary school and university levels, the number of students to be accommodated will depend not only on the growth of school-age and university-age population, but on social and economic factors as well. Policy decisions will affect both enrolment and standards of physical provisionment. Not enough is known about the existing Canadian school stock to say with any confidence how adequate it is in relation to present enrolment, or what would be the cost of making up any apparent backlog. The representative cost of new schools, let alone of new university and college facilities, is also hard to determine.

For all these reasons, a national forecast of school and university capital requirements, like the other forecasts in the study, must be in the nature of an exercise, based on simplifying assumptions. No attempt is made to indicate a range of error, but it is hoped that the physical standards and cost estimates used are not too unrealistic in relation to average Canadian practice.

Factors Determining School Building Requirements

The preceding discussion will have suggested some of the factors which should be taken into account in forecasting expenditure on elementary and secondary schools. The prospective increase in total enrolment promises to be by far the most important generator of new building requirements. But allowance should also be made for further shifts of population, particularly from farm to urban areas. As experience prior to 1950 showed, this can create a need for new facilities even when the nation's school plant is theoretically capable of accommodating all who are required or who wish to attend school. What happens, in effect, is that a certain amount of rural school capacity becomes useless where it is, and a counterpart must be erected elsewhere.

The physical consolidation of small rural schools[3] amounts to the same thing so far as building requirements are concerned. In some prairie localities, the ingenious practice has been followed of towing a number of existing schools to a new site and joining them together, with perhaps an extra room or two added on; but in general, unless the population of the area has declined substantially, it may be assumed that physical consolidation means either a new building or a large addition to an existing building.

Many school classrooms, particularly elementary-school classrooms, are today considered to be overcrowded. The rooms may in some cases be quite capable of holding 40 or more pupils without undue congestion or danger to health; the real objection is that beyond a certain number of pupils, effective teaching becomes increasingly difficult and finally impossible. In a sense,

[3]As distinct, that is, from the administrative consolidation of school districts, which generally precedes it.

much present overcrowding may be more directly related to the teacher shortage than to lack of physical facilties; but outside of some rural areas, there are probably few extra classrooms available, and if one assumes (as is done here) that the teacher shortage will ultimately be made good, provision should be made for some additional rooms as part of the remedy.

Finally, allowance should be made for the reconstruction or replacement of school buildings which are or will become too old and run down or otherwise unsatisfactory.

The Prospective Increase in Elementary and Secondary School Enrolment

Thanks in part to compulsory school attendance laws, most Canadian children now complete their primary education. A majority of them, however, do not complete secondary school or its equivalent,[4] and while the percentage of "drop-outs" has tended to decline, the rate of attrition after Grade VII or VIII will probably always be considerable. For this reason, prospective increases in elementary and secondary school enrolment must be discussed separately

In the first three columns of Table 22 are shown the estimated population of elementary-school age (six to fourteen) for certain school years from 1944-45 to 1979-80, the actual enrolment in elementary schools from 1944-45 to 1953-54, and the relationship between the two series up to 1953-54. Between 1944-45 and 1953-54, enrolment rose from 89.4% to 94.5% of the elementary-school-age population.

If one were to measure the trend over the period as a straight line and project it to 1979-80, by that year the percentage would be 110.8%. This is not necessarily an absurdity: enrolment figures include some four-year-olds and even more five-year-olds in kindergarten, together with some laggards and retarded children over 14 years of age, so that it would be theoretically possible for the percentage in question to exceed 100. In Ontario, enrolment as a proportion of the 6-to-14 age-group in 1950-51 was 98%—the highest of any province; but the percentage may since have dropped, for crowding has

[4]This may be inferred from the following table:

Enrolments in Grade VII to XI, 1951-52, expressed as percentages of the different Grade II enrolments from which they would normally be derived.

Province	Enrolments as percentages of Grade II enrolments				
Grade:	VII	VIII	IX	X	XI
Newfoundland	70	53	49	36	25
Prince Edward Island	92	84	61	62	29
Nova Scotia	84	69	57	13	30
New Brunswick	76	61	41	24	16
Quebec: Catholic	66	35	na	na	na
Protestant	96	87	68	51	34
Ontario	94	88	79	59	36
Manitoba	89	75	63	46	34
Saskatchewan	79	74	59	42	31
Alberta	96	87	78	57	43
British Columbia	107	110	97	61	48

SOURCE: *School Finance in Canada*, p. 22, School Finance Research Committee, The Canadian School Trustees' Association (LaZerte, M. E., research director). The figures are, of course, affected by death and migration. But they do suggest that, in the country as a whole, less than half of the surviving members of most Grade II classes have been reaching Grade XI.

forced the discontinuance of some kindergarten classes. On the whole, it would seem realistic to suppose that the national percentage is now near its peak.[5]

Table 22

PUBLIC ELEMENTARY SCHOOL ENROLMENT IN CANADA PROJECTED TO 1979-80

(thousands)

School year	(1) Population of elementary — school age (6-14 years)[a]	(2) Actual elementary school enrolment[b]	(3) Elementary enrolment as percentage of elementary — school age population: Actual (col. 2 as percentage of col. 1)	(4) Calculated on basis of: 10-yr. trend[c]	(5) Calculated on basis of: Estimated trend	(6) Forecast of elementary school enrolment (col. 1 x col. 5)
1944-45	1,879.5	1,680	89.4	89.2		
1945-46	1,903.8	1,699	89.2	89.8		
1946-47	1,937.9	1,753	90.5	90.4		
1947-48	1,979.1	1,795	90.7	91.1		
1948-49	2,095.2	1,927	92.0	91.7		
1949-50	2,148.4	2,006	93.4	92.3		
1950-51	2,223.3	2,061	92.7	92.9		
1951-52	2,322.9	2,167	93.3	93.5		
1952-53	2,430.4	2,289	94.2	94.2		
1953-54	2,548.2	2,409	94.5	94.8		
1954-55	2,670.7				94.9	2,534
1959-60	3,281.7	—	—	98.4	95.0	3,118
1964-65	3,706.5	—	—	101.5	95.0	3,521
1969-70	3,924.8	—	—	104.6	95.0	3,729
1974-75	4,173.0	—	—	107.7	95.0	3,964
1979-80	4,581.0	—	—	110.8	95.0	4,352

a At June 1 of the school year indicated. The figure for 1950-51 is taken from census data, figures for other years up to and including 1954-55 are estimates made by the Dominion Bureau of Statistics. Figures for 1959-60 and other future years are derived from the population forecast used in this study. See, *Output, Labour and Capital in the Canadian Economy*, a study prepared for the Royal Commission.

b SOURCE: Dominion Bureau of Statistics, Education Division. Elementary grades are from kindergarten to Grade VII, inclusive, in Quebec, and from kindergarten to Grade VIII in other provinces. Quebec independent schools are included.

c Ten-year trend, 1944-45 to 1953-54, measured as a straight line and projected to 1979-80.

In column 6 of the table appear estimates of future enrolment, calculated on this assumption. By 1979-80, there would be a total of 4,352,000 pupils in elementary schools—80% more than in 1953-54.

The possible increase in secondary school enrolment is forecast in Table 23. In 1944-45, actual secondary school enrolment, expressed as a proportion of the estimated number of persons aged from 14 to 17 years inclusive,[6]

[5] It should be noted that the elementary school enrolment figures do not include pupils in independent schools outside the province of Quebec. Also, of course, some children—e.g. invalids and mental cases—are exempted from school attendance.

[6] It will be observed that the elementary and secondary school age groups used in these calculations overlap, and that the secondary group embraces only four years, whereas in some provinces the complete high school course is five years long. Without going into the technicalities of the matter, it may be explained that the age groups selected seemed to be about the most relevant ones which could conveniently be calculated from the available population data.

was 44.4%. By 1953-54, it had risen to 53%. If the trend over the period is measured as a straight line and projected, a percentage of 74.9 is indicated for 1979-80.

Table 23

SECONDARY SCHOOL ENROLMENT IN CANADA PROJECTED TO 1979-80

(thousands)

School year	(1) Population of secondary school age (14-17 years)[a]	(2) Actual secondary school enrolment[b]	(3) Secondary school enrolment as percentage of secondary school age population			(6) Forecast of secondary school enrolment (col. 1 x col. 5)
			Actual (col. 2 as percentage of col. 1)	(4) Calculated on basis of: 10-yr. trend[c]	(5) Calculated on basis of: Estimated trend	
1944-45....	860.2	382	44.4			
1945-46....	852.0	402	47.2			
1946-47....	846.8	407	48.0			
1947-48....	841.8	403	47.9			
1948-49....	864.2	408	47.2			
1949-50....	860.1	416	48.4			
1950-51....	848.5	432	50.9			
1951-52....	864.1	440	50.9			
1952-53....	881.9	464	52.6			
1953-54....	907.9	484	53.3			
1954-55....	938.2			53.7	53.7	504
1959-60....	1,169.9	—	—	58.0	57.0	667
1964-65....	1,458.6	—	—	62.2	60.3	880
1969-70....	1,666.9	—	—	66.4	63.6	1,060
1974-75....	1,751.9	—	—	70.7	66.9	1,172
1979-80....	1,841.8	—	—	74.9	70.0	1,289

a At June 1, of the school year indicated. For source of data, see note at bottom of preceding table.

b SOURCE: Dominion Bureau of Statistics, Education Division. Secondary grades are from Grade VIII to Grade XII inclusive in Quebec, and from Grade IX to Grade XII or XIII in other provinces. Enrolment in private schools in all provinces is included. For details of secondary grade enrolment in the Province of Quebec, see Appendix II.

c Ten-year trend, 1944-45 to 1953-54, measured as a straight line, and projected to 1979-80.

In asking whether this is a reasonable percentage to expect, one is really asking several questions: *How many children will enter secondary school? How many will stay on for the final or matriculation year? At what stage will the rest drop out?* Much will depend on the nature and scope of future secondary school education—on the job or jobs which the secondary school is expected to do. It is worth remembering that secondary education in Canada has undergone a virtual revolution over the last two or three decades:

> "A good many people have not yet realized that present-day school attendance laws, requiring boys and girls to attend school until they reach 16 years of age, have the result of making it necessary for all

> boys and girls of ordinary intelligence to experience at least a year or two of secondary schooling. Such persons often sigh for the days in which the high school had a single, simple task, that of preparing an able and industrious few for higher education and, particularly, of giving them a start on their training for public service in the learned professions. In that day, the obvious duty of the high school, so far as the less able and the less willing were concerned, was simply to detect them and eliminate them from its programme. Today, the secondary school faces a vastly more difficult, more complicated, and more important responsibility. It still is required to discover the able and the industrious and to give them the chance of preparing for the universities and the other schools of higher learning if they desire to proceed in that direction. But it also must remember that even the able and industrious may elect to proceed in other directions, and it has the additional duty of outlining for others, less able or less willing to devote themselves to professional service, appropriate courses to prepare them to live usefully and with satisfaction in a world of ever more technical and more specialized occupations."[7]

One obvious development tending to increase the ratio of secondary-school enrolment to the secondary-school age-group would be an upward revision of minimum school-leaving ages. In most provinces, there does not at present seem to be much pressure for such a move—some people have even expressed the belief that present legal minima may be too high.

But there are factors which are likely, over a period of time, to make children stay on longer at school even if they are not legally compelled to do so. The ever-growing complexity of business, industry and government, and of society in general, will doubtless make education well beyond the primary stage more and more desirable.

The retention power of secondary schools may be increased by a more general offering of courses capable of interesting children who do not choose, or who lack the ability, to prepare themselves for higher education and the professions. Just how far the secondary school should proceed along the road to something for everybody is, and will probably continue to be, a subject for debate. But at the very least, one would expect rural and small-town high schools gradually to widen the scope of their offerings to something ap-

[7]Althouse, J. G., "Significant Trends in Education in Ontario", *University of Toronto Quarterly*, January 1956, p. 239. It should be noted that in most provinces, the minimum school-leaving age is less than 16. The following are what might be called the standard minimum leaving ages in the ten provinces. Certain exemptions are allowed, and in some provinces a measure of local option is permitted. In Manitoba, for example, any school board having a school officer may pass a by-law requiring children to attend school until they are 16. In New Brunswick, the ratepayers of certain districts may reduce the minimum leaving age to 14.

"Standard" Minimum School-Leaving Ages

Newfoundland	15	Ontario	16
Prince Edward Island	15	Manitoba	14
Nova Scotia—urban	16	Saskatchewan	15
—rural	14	Alberta	15
New Brunswick	16	British Columbia	15
Quebec	14		

proaching the breadth which now characterizes most big-city school systems. The further progress of school consolidation will be an important determinant of how fast this takes place.

One may expect too that highway improvements and the extension of school bus service will lessen the number of children who cannot go to high school without living away from home.

The action of some other forces on enrolment is more difficult to foresee. If employment remains high and incomes continue to rise, the number of children who have to leave school in order to help support their families will doubtless be reduced. On the other hand, general prosperity and the prospect of immediate gainful employment have a way of tempting teen-agers from their studies.

Academic standards and pupil promotion policies should also be mentioned as having a bearing on enrolment. Easier promotion is believed to account in part for the much higher enrolment percentage of United States high schools.[8]

The future size of the secondary school population thus depends on a number of variables. In the end, the forecast of enrolment has to be very much a guess. Consultation with competent authorities suggests that possibly the 74.9% of column 4 of Table 23 is a little high. The ratio has therefore been reduced to 70%, and the ratios for other years adjusted accordingly. On this basis, secondary enrolment by 1979-80 would be 1,289,000—166% greater than in 1953-54. It can be seen that in proportionate terms, the pressure for new secondary schools is expected to be much greater than that for new primary schools.

Population Shifts

Two kinds of population shift—from rural farming areas to urban areas and from central areas to suburbs—are likely to have an important effect on school building requirements over the next 25 years.

In Chapter 2, a net decline of 481,000 in the rural farm population is forecast for the period 1951-80. Much of this may have taken place already; and most of the rest, it is believed, will have occurred by 1965.

If the people moving from farms were a representative "cut" of the national population so far as age distribution was concerned, 17% of them would be of elementary school age, and a further 6% of secondary school age, although only about 3% might actually attend secondary school.

Perhaps 50,000 extra school places, 40,000 in elementary schools and 10,000 in secondary schools, would be a reasonable provision for the *further* movement from farms.

[8] "In 1953, 6,358,000 boys and girls were in high school, 92.5 percent of all persons between 14 and 17 years." (*Report of the U.S. Study Committee on Federal Responsibility in the Field of Education*, June 1955, p. 67.)

The second kind of population shift likely to have a significant bearing on school requirements—the so-called "flight to the suburbs"—is unfortunately almost impossible to forecast, and no allowance is made for it here. Often, it is not so much a net decline in the total population of the central area as a change in the composition of that population which causes an emptying of classrooms in older districts and a corresponding need for further accommodation elsewhere. People with school-age-children move away to the suburbs and are replaced by single persons and childless or elderly couples. Sometimes, and especially when the pressure on suburban accommodation is great, arrangements may be made to bring children into the older schools by bus.

School Consolidation

The small rural school has in its time produced many distinguished Canadians; but its inherent disadvantages are now widely recognized. Two or more grades—sometimes all grades—must be taught in a single room. Teachers cannot specialize but must try to be competent in a variety of subjects. To offer alternative courses and to provide facilities for instruction in technical and commercial subjects may be difficult if not impossible. In many rural districts, children must choose either an academic high school education or none.

The development of all-weather roads has made it possible to overcome these disadvantages by consolidating rural schools into fewer and larger units, to which pupils are brought by bus. If the new school is large enough, it is likely to be more attractive to both teachers and pupils. Teachers are not made responsible for more than one grade and one subject at a time, and for this reason can handle larger classes yet do a better job of instruction. That consolidation often reduces the total number of teachers required in a given area (many small rural schools have quite low classroom enrolments) is an important point in its favour at a time of teacher shortage. The resultant savings may be used to increase salaries. Since consolidated schools are generally located in towns or even cities, the teacher is likely to have a better chance of finding good living accommodation, companionship and recreational facilities.

To the pupil, the consolidated school usually offers not only better but more varied instruction. More options may be available, and the inducement to stay on at high school is likely to be strengthened.

How many schools in a province should be consolidated is something which only experts, in close touch with local situations, can rightfully judge; and even then there will tend to be differences of opinion. How fast consolidation actually does take place depends on such things as geography, the state of the road system, the views of local taxpayers, and the amount of pressure or inducement that is forthcoming from provincial governments.

It may be observed that the consolidation of school districts and the erection of larger schools has gone ahead much more rapidly in some provinces than in others.

Future school consolidation in Canada is thus extremely difficult to forecast.

It does, however, seem reasonable to suppose that a great many one-room schools will be replaced by larger units over the next 25 years. Some partial statistics are available concerning the number of such schools in eight of the ten provinces (Ontario and Quebec excepted). In 1953-54, out of 12,974 schools reporting, 8,399 or 65% had only one classroom.[9] Some were elementary schools, some secondary schools, and some combined elementary and secondary schools. The number of each is not known.

There could well be as many as 12,000 more one-room schools in Ontario and Quebec, for a national total in the neighbourhood of 20,000. If the average enrolment per school were 19,[10] the total enrolment would be 380,000.

Not all one-room schools are likely to be consolidated: there are certain limits to the process set by geography and population dispersal. Then too, the disadvantages of the small school are probably not so serious at the elementary as at the secondary level.

But it would seem realistic enough to expect that somewhat more than half the present number of one-room schools will be replaced by larger units during the next quarter century. Provision should therefore be made for new consolidated schools to accommodate, say, 200,000 pupils.

In fact, consolidation is likely to take place on an appreciably greater scale than this. Many two-room, three-room, and even larger schools will probably be caught up in the process. In Saskatchewan, with its high proportion of rural population, capital expenditure on school consolidation over the next five years is expected to amount to $18.8 million—$15 million on buildings, and $3.8 million on school buses. This is a substantial figure when compared with an estimated $29.3 million to take care of increased enrolment over the same period.[11]

Reduction of Crowding

Opinions vary as to how many pupils a school teacher should be asked to instruct in one room at one time. The nature of the subject taught makes a difference: 35 pupils may be a reasonable number in a history class, but excessive in a shop or laboratory. Some people think that secondary classes can safely be larger than elementary ones because the pupils are usually

[9] See Appendix III.

[10] See Appendix IV.

[11] *Prospects for Economic Growth in Saskatchewan*, brief of the Province of Saskatchewan, p. 220.

quieter and more amenable to discipline; others argue that secondary courses call for more teacher attention per pupil.

Most provincial briefs to the Royal Commission set 30 pupils per classroom as a desirable standard for the future. Perhaps, then, it is not too severe to state that, by and large, any classroom with more than 35 pupils in it should be regarded as crowded.

Statistics relating to eight provinces (Quebec and Ontario again excluded) indicate that roughly 40% of the students covered were enrolled in classes of 35 or more.[12] The excess enrolment for which facilities would have to be provided if no class were allowed to have more than 35 pupils may be approximately calculated as 4.7% of total enrolment.

If it could be assumed that crowding bore the same relationship to total enrolment in Ontario and Quebec as in the other eight provinces together, then the excess class enrolment in the country as a whole could be estimated at 143,000.

The point was made earlier that crowding may in a sense be more related to the teacher shortage than to lack of classroom space. In Table 24 is an estimate of the teacher shortage in elementary and secondary schools at the end of 1953. It is believed that the situation has improved little, if at all, since then.

Table 24

ESTIMATED TEACHER SHORTAGE IN CANADIAN SCHOOLS, 1953

Newfoundland	1,000
Prince Edward Island	35
Nova Scotia	878
New Brunswick	349
Quebec	1,200
Ontario	1,175
Manitoba	104
Saskatchewan	173
Alberta	75
British Columbia	150
Total	5,139

SOURCE: Education Division, Dominion Bureau of Statistics.

If this shortage were to be made good, and if each of the 5,139 additional teachers were to be assigned a new 30-pupil classroom, the facilities required would be the same as for an enrolment increase of 154,170 pupils.

Neither of these two measures is at all satisfactory. The first suffers from lack of information on Quebec and Ontario, while the second is open to the objection that in some fields—e.g. high school mathematics and sciences—

[12]See Appendix V.

the teacher shortage may not at present be associated with anything like a corresponding shortage of physical facilities. That is, if the mathematics and science teachers could be found, the necessary additions to plant might be relatively quite small.

Perhaps, however, it would not be overstating matters to guess that if over-populated classes are to be brought down to a reasonable size, new facilities should be provided on this account alone for at least 140,000 pupils.

Reconstruction and Replacement

The useful life of a school, where pupils are available to fill it, depends on such things as how well it is built and maintained and how easily its structure and layout can be adapted to modern teaching requirements and modern standards of lighting, ventilation and sanitation. In cities in central Canada, many brick-built schools 50 and more years old are still in use. Possibly some of them would have been replaced before now had it not been for the postwar pressure on accommodation. Some new schools are deliberately built not to last as long as 50 years, on the argument that wholly different kinds of schools may be wanted two or three decades hence.

Discussion of the subject is not particularly helpful in the present context, since virtually nothing is known about the age distribution of the existing school stock. One can be certain, however, that a fair amount of "pure" replacement (i.e., replacement not occasioned by school consolidation or by shifts of population) and major reconstruction will have to take place over the next 25 years. An allowance of 20% of the present school stock, expressed in terms of enrolment, does not seem excessive. This would mean new or substantially rebuilt facilities for about 500,000 elementary and 100,000 secondary pupils.

School Costs

The average cost of elementary schools is usually estimated on the basis of cost per classroom.[13] In its brief to the Royal Commission, the Province of Newfoundland estimates the cost of an elementary classroom at $10,000. The corresponding New Brunswick estimate is $12,500, and the same figure is quoted for Nova Scotia in the Pottier report. The average cost in Ontario is reported to be about $600 per student, while in Manitoba the cost per classroom of elementary and secondary schools together is estimated at $14,000.[14] Saskatchewan forecasting is based on a capital cost of $800 per elementary pupil. Alberta and British Columbia, like Manitoba, lump elementary

[13]"Cost per classroom" here means the total cost of a typical elementary school divided by the number of classrooms in it, not the cost of a single classroom standing in isolation.

[14]Excluding specialized facilities such as auditoria, gymnasia, etc.

and secondary school costs together. The figures given are $28,000 per classroom in Alberta and $1,000 per student in British Columbia. In Quebec, the cost of an elementary classroom has been estimated at $19,000.[15]

Interprovincial differences in school costs may be partly accounted for by differences in the kind of construction employed. In the Atlantic provinces, for example, frame construction is more widely used than it is in Ontario.

Newspaper reports indicate that the cost of elementary schools in large urban areas is likely to run fairly close to the figures quoted above for Ontario and Quebec. It seems likely that the majority of new schools will be built in urban areas and that rural schools will more and more tend to be built to urban standards. Perhaps, then, a cost factor of $20,000 per classroom, inclusive of all equipment, is an appropriate one to use. With an average class enrolment of 30, the cost per pupil would be $667.

Secondary schools are of a number of types, some of which cost more than others. As a rule, "composite" high schools[16] are more expensive than "academic" schools, while technical and vocational schools are the costliest of all.

The cost of secondary schools is rarely estimated on a per-classroom basis. A large secondary school may have a number of rooms such as workshops, laboratories, etc. which are not classrooms properly speaking, but which are in use most of the time and consequently form part of the pupil capacity of the school plant. In a technical school, ordinary classrooms may be only a small part of the total plant.

In their briefs to the Royal Commission, the Provinces of Ontario and Saskatchewan both quote a figure of $1,400 per student as the estimated cost of future secondary school facilities. This is the figure used here. It is, of course, to be taken as an average, possibly about right for a composite school but too high for an academic school and too low for a technical or vocational school.[17]

School Requirements in Dollars

In Table 25, the calculations of elementary and secondary school requirements in terms of pupil places have been converted into dollars with the aid of the appropriate cost factors.

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[15]Ace-Kellog-Laval conference report, p. 60.

[16]In most provinces, "composite high school" is the term used to designate a secondary school which offers academic, technical, commercial and sometimes other courses in the same building.

[17]The cost of secondary schools in Quebec is peculiarly difficult to estimate owing to the prevalence of the classical college, which to English-speaking Canadians unfamiliar with it can perhaps be described as usually something like a combined secondary school and liberal arts college. One estimate puts the cost of a typical classical college at $4,000 a student. This is far more expensive than an ordinary high school, but less expensive than most universities.

Table 25

FORECAST OF SCHOOL CAPITAL REQUIREMENTS

(millions of 1955 dollars)

	Allowance for:					
	Increased enrolment	Shifts of population	Consolidation (partial allowance only)	Reduction of crowding	Reconstruction and replacement	Total
1. Elementary schools						
Period						
1954-55 to 1959-60	390	14	14	17	67	502
1959-60 to 1964-65	269	13	14	17	67	380
1964-65 to 1969-70	139	—	13	17	67	236
1969-70 to 1974-75	157	—	13	17	67	254
1974-75 to 1979-80	258	—	13	16	66	353
1954-55 to 1979-80	1,213	27	67	84	334	1,725
2. Secondary schools						
Period						
1954-55 to 1959-60	228	7	28	4	28	295
1959-60 to 1964-65	298	7	28	4	28	365
1964-65 to 1969-70	252	—	28	4	28	312
1969-70 to 1974-75	157	—	28	4	28	217
1974-75 to 1979-80	164	—	28	4	28	224
1954-55 to 1979-80	1,099	14	140	20	140	1,413

University and College Enrolment

On arriving at the consideration of university enrolment,[18] one passes from under the shadow of the school attendance laws. Nobody is legally compelled to go to university; a relatively small minority of the population actually does so; and the complex of factors which governs the size of total university enrolment is different in many ways from that which operates on secondary school enrolment. The size of the university-age population is obviously of some significance, and so are the scope and standard of university education; but fee scales, levels of personal income, and the availability of financial assistance for needy students are also important. Much depends on how highly society chooses to value a university education and on the material and other rewards to be expected as a result of graduation.

Many people might be disposed to consider future university enrolment in the light of the nation's probable need for university-trained men and women. This is certainly a most important relationship, but it would be an unrealistic and misleading basis for a forecast. Universities are probably at least as conscious as other institutions of their responsibilities to society, but they conceive of those responsibilities in terms of quality as well as of quantity. So long as this is true—so long, that is, as the setting and maintenance of academic standards are regarded as being central to the very idea of a university—there can never be any assurance that university enrolment and university output will necessarily measure up to some independent criterion of national need. How, in any case, would the need be established? It might be possible to produce a fairly plausible forecast of requirements in a field such as engineering. But how many arts graduates will be needed by 1980?

Once again, therefore, it seems best to look at past trends, and to make some assumption as to what enrolment is likely to be as a proportion of the university age-group by 1980. The procedure is broadly the same as that followed by Dr. E. F. Sheffield in his forecast of university enrolment to 1965.[19] The 18-21-year age-group is chosen as the most relevant, and the assumption is made that post-graduate enrolment will bear a constant percentage relationship to undergraduate enrolment.

Table 26 indicates that since the Second World War, enrolment as a percentage of the age group mentioned has shown a distinct tendency to rise. In 1954-55, the proportion was 7.5% compared with 4.5% in 1944-45. The statistics go back further: in 1940-41, the proportion was 4.2%; in 1930-31, 4.2%; and in 1920-21, 3.9%.

[18]University enrolment is considered to include students in post-matriculation courses at classical colleges in the Province of Quebec.

[19]Sheffield, E. F., *Canadian University and College Enrolment Projected to 1965*, paper presented before the National Conference of Canadian Universities, Toronto, June 10, 1955.

Table 26

FULL-TIME UNIVERSITY AND COLLEGE ENROLMENT IN CANADA (LESS VETERANS ON ALLOWANCE) PROJECTED TO 1979-80

	(1)	(2)	(3)	(4)	(5)	(6)
			Enrolment as % of college-age population			
Academic year	University-age population (18-21 years)[a]	Full-time enrolment, exclusive of veterans on allowance[b]	Canada (col. 2 as percentage of col. 1)	U.S.A. (comparable)[c]	Calculation on basis of 11-year trend	Forecast enrolment to nearest 100 (col. 1 x col. 5)
1944-45	872,560	39,511	4.5	n.a.[d]	5.0	
1945-46	867,000	44,231	5.1	n.a.	5.3	
1946-47	865,240	44,911	5.2	n.a.	5.6	
1947-48	860,760	52,985	6.2	n.a.	5.8	
1948-49	880,120	57,564	6.6	n.a.	6.1	
1949-50	872,320	60,234	6.9	19.3	6.4	
1950-51	856,880	61,626	7.2	n.a.	6.7	
1951-52	867,400	61,352	7.1	n.a.	7.0	
1952-53	871,800	61,664	7.1	n.a.	7.3	
1953-54	883,640	63,620	7.2	n.a.	7.6	
1954-55	894,440	67,148	7.5	n.a.	7.8	
1959-60	1,007,480	—	—	—	9.3	93,700
1964-65	1,244,840	—	—	—	10.7	133,200
1969-70	1,509,520	—	—	—	12.1	182,700
1974-75	1,686,440	—	—	—	13.6	229,400
1979-80	1,779,760	—	—	—	15.0	267,000

a Forty per cent of those 15 to 24 years of age on June 1 at the end of the academic year. Figures for years up to and including 1954-55 are derived from Dominion Bureau of Statistics census data and intercensal estimates. Figures for later years are derived from the population forecast used in this study.

b SOURCES: Years up to and including 1951-52, *Survey of Higher Education 1950-52*, Dominion Bureau of Statistics. Figures for later years are estimates based on preliminary returns to the D.B.S.

c SOURCE: *Statistical Summary of Education*, Biennial Survey of Education, U.S. Office of Education.

d n.a. indicates that data are not available.

One can only guess what factors have done most to bring about this long-term increase. High employment and rising incomes have doubtless been a potent influence. Notwithstanding increases in living costs and university fees, it seems reasonable to suppose that more young people have parents who can afford to send them to university and that for those who are not in this fortunate position, the prospects of raising the necessary funds by vacation and part-time work are better than they were in the '30's or even, probably in the '20's. There may still, unhappily, be many people able and willing to undergo university training who are prevented from doing so by financial difficulties—the necessity of contributing to the support of others is often the worst hurdle—but their proportion must have decreased somewhat.

Growing recognition of the value of university education may also have done much to increase the participation rate. The range of occupations for which a university degree is an essential ticket of admission has steadily widened. But there is perhaps, too, a more general appreciation, not entirely related to employment opportunities, of the benefits which university work and exposure to the university atmosphere can bring.

In assuming that enrolment as a percentage of the university age-group will go on increasing, one is really assuming that the above factors will continue to operate—that the financial barriers to admission will become relatively less difficult to surmount and that the desire for and appreciation of university education will continue to spread.

Consideration was given to three possible periods as bases for projection: 1924-25 to 1954-55, 1944-45 to 1954-55, and 1949-50 to 1954-55. The first was rejected on the grounds that the depression years probably introduce a distorting element. The third period produced the smallest enrolment forecast of all, owing to an apparent levelling off in the participation rate about 1951. It was thought unwise to give this too much weight, since it was apparently only a temporary phenomenon. The final choice therefore lit on the second period, 1944-45 to 1954-55. This choice may, of course, err on the side of expansiveness. Implicit in it is the idea that somewhere about the end of World War II, and quite apart from the inrush of returning veterans, the rate of increase in the desire and need for university education itself underwent an increase—one which is likely to be maintained for some time.

In column 1 of Table 26 are shown the estimated population of university age from 1944-45 to 1954-55 inclusive and the forecast population of the same age for every fifth year thereafter to 1979-80.[20] Actual enrolment in universities and colleges[21] from 1944-45 to 1954-55, exclusive of veterans

[20]The Sheffield forecast for any given year is based on births 18-21 years earlier. Here, by contrast, the college-age population for any given future year is simply derived from the over-all population forecast for the same year.

[21]Including post-graduate enrolment. The majority of post-graduate students are probably over 21, but it is being assumed for projection purposes that their numbers will bear a constant relationship to undergraduate enrolment.

on allowance,[22] is shown in column 2; while in column 3, enrolment is expressed as a percentage of the university-age population. The trend in the percentage is measured as a straight line and projected, with results as shown in column 5. Simple multiplication then produces the forecast of university enrolment shown in column 6.

The forecast would indicate that by 1979-80, university students might number 267,000—almost four times the 1954-55 figure. Total enrolment would be equivalent to 15% of the 18-21-year age-group. It is of some interest to break down the net increase in enrolment by 5-year periods:

Table 27

FORECAST INCREASE IN UNIVERSITY AND COLLEGE ENROLMENT, BY PERIODS

Period	Net increase in number of students	% Increase in number of students
1954-55 to 1959-60	+ 26,552	+ 40%
1959-60 to 1964-65	+ 39,500	+ 42%
1964-65 to 1969-70	+ 49,500	+ 37%
1969-70 to 1974-75	+ 46,700	+ 26%
1974-75 to 1979-80	+ 37,600	+ 16%
Total	+199,852	+298%

From this it would seem that the biggest absolute increase in enrolment is likely to occur between 1964-65 and 1969-70 and that the increase between 1969-70 and 1974-75 may be just about as great.[23] Over the whole period however, and particularly from 1959-60 on, the pressure for new facilities seems likely to be intense.

It may be pointed out that 15% would be, in some lights, a very modest proportion of the 18-21-year age-group to have in university by 1979-80. The comparable United States percentage in 1949-50 was 19.3 and has undoubtedly increased since.[24] There are reasons for believing that Canada may never catch up to the United States in this respect: American university education embraces a wider range of courses and standards than its Canadian counterpart. Nevertheless, American college-going habits must be expected to have some influence on Canadian ones.

On the other hand, attention should be given to what may be the total potential supply of university raw material. Some authorities accept as a very rough rule of thumb the notion that to be a good university prospect, a person should probably have an I.Q. of 115 or more. By this measure,

[22]There is no thoroughly satisfactory method of eliminating the special influence of enlistment in the armed forces and the veterans' allowance scheme. The scheme doubtless resulted in many people attending university who would not otherwise have been able to do so. Others, however, would probably have managed to attend on their own or their parents' resources: some, indeed, had done a year or more of university prior to enlistment but naturally welcomed the allowances as a help, if not always as a necessity, in completing their courses.

[23]The time pattern is likely to be different in Quebec, where completion of a 4-year post-matriculation course in a classical college is still, by and large, a prerequisite for entry into university proper.

[24]A rough figure of 30% is sometimes quoted.

perhaps 20% of the population would be eligible. Allowance would have to be made for people with lower I.Q.'s who could surmount their disadvantage in this respect by hard work; but there would have to be allowance, too, for people of high intelligence who would not choose to go to university, or who, if they did, would not apply themselves sufficiently.[25]

The meaning and interpretation of I.Q. tests are subject to controversy, and few if any universities would want to base the selection of students wholly or even largely on the results of such tests. But the inference remains that under present academic standards the proportion of children who are potential university material is probably quite limited. Efforts to increase the supply of university-trained manpower seem likely to be concentrated on identifying this proportion at the earliest possible age, on providing it with adequate school preparation and on giving it every sort of encouragement to enter university.

Some Proposed Steps to Deal with Increased University Enrolment

Thanks in part to the Sheffield study, university authorities are by no means unaware of the flood which seems to await them and of the staff and building problems which are implied. The subject has been publicly discussed, and a number of proposals have been put forward. Some possible courses of action may be briefly enumerated:

1. Existing institutions might be expanded in roughly equal proportion. For an already large university such as Montreal or Toronto, a quadrupling of present enrolment would bring the student body to something like 30,000.

2. A disproportionate share of expansion might be loaded on the smaller institutions. For some universities which have deliberately remained small in the belief that much of their distinctive character and quality is due to their size, this would represent a decided change of policy.

3. New universities might be created—though hardly by the stroke of a pen.

4. Some first and second year enrolment might be channelled into new junior colleges:

> "Colleges of this type would give tuition equivalent to that provided in the first two years of university training. Graduates of junior colleges could then either go on to university and gain a degree or terminate their education at the former stage. In this manner, it is hoped that the universities would be relieved of some of the pres-

[25] In an address to the National Conference on Engineering, Scientific and Technical Manpower, J. D. Barrington, president and managing director of the Polymer Corporation, said that persons with I.Q.'s of 110 or more were likely to be good university prospects. On this basis, he estimated that 25% of the school age population might be considered eligible. A further 8% might make up for lower I.Q.'s by hard work. (Barrington, J. D., "Have We the Human Resources to Satisfy Our Technical Needs", *Financial Post*, September 15, 1956, pp. 17-21.)

> sures on them. In addition, the opportunity would be provided to students who did not wish to continue their education further, or who were not up to university standards, to terminate their formal education at completion of junior college."[26]

Conceivably, junior colleges might be set up in important regional centres in a province—initially, perhaps, as protégés of senior institutions. Where the experiment proved successful, the college might gradually acquire the status and facilities of a full university.

5. Technical institutes might be established with a view to providing instruction about mid-way between the vocational school and university levels.

6. University admission standards might be raised; or at any rate, an attempt might be made to increase the efficiency of selection procedures. Some work in the latter direction is under way in Ontario. High failure rates, particularly in first-/and second-year classes, are taken as an indication that universities are wasting too large a part of their resources on people who are unfitted for university work. But the net effect of better selection might turn out to be small: more goats might be turned away, but some previously unsuspected sheep might be admitted.

No assumption is being made as to the extent to which any or all of these courses may be followed. It should be pointed out, however, that they do have implications for capital requirements. If, for example, a significant part of the expected increase in enrolment is channelled into junior colleges and technical schools, the facilities needed may not be quite so costly.

The Cost of University Facilities

Here again, the capital cost implications of the projected increase in enrolment can probably best be forecast through the medium of a cost-per-student factor. Such a factor is, however, more difficult to estimate for universities than for schools. The scope and standard of facilities vary more from one institution to another. Differences in the range and emphasis of curricula make for large differences in capital cost per student: a university which stresses, say engineering and medicine, will have to make particularly heavy outlays in order to expand its facilities.

A number of universities which together account for about 80% of the total Canadian university enrolment submit regular estimates of the value of their plants to the Dominion Bureau of Statistics. Expressed on a dollars-per-student basis, plant values would appear to have risen rapidly in recent years.

[26] *Brief of the Province of Ontario*, p. 135.

Table 28

PLANT VALUE PER STUDENT OF REPORTING UNIVERSITIES

Year	Dollars/student	Year	Dollars/student
1945-46	2,000	1950-51	3,000
1946-47	1,800	1951-52	3,500
1947-48	1,800	1952-53	3,800
1948-49	2,200	1953-54	3,900
1949-50	2,500		

SOURCE: Education Division, Dominion Bureau of Statistics.

These are believed to be book-value figures for the most part: current replacement values are probably much higher. Having regard to this, and assuming that there is little surplus capacity in Canadian universities,[27] one might begin with a guess that the average cost, per additional student, of new facilities would be at least $4,000, and probably a good deal more.

Developments might well occur which would tend to push up both the average and the marginal plant value per student—i.e., would tend to bring about an increase in both the total plant value per student enrolled and the theoretical addition to plant made necessary by each additional student. A greater relative enrolment in "capital-intensive" courses—e.g., mechanical engineering—would be one such development. Another would be a general tendency to house a larger proportion of students on campus in university residences: more than one university has already set this as a long-term goal. It could be, too, that there will be greater relative provision for cafeterias, gymnasia, student unions, and other ancillary facilities, although if the financing of new and expanded teaching plants proves difficult, some projects may have to wait.

Some university capital needs are not necessarily influenced by enrolment at all. Research facilities are a good example: to some extent the need for them may be a function of post-graduate enrolment, but the inauguration or expansion of a branch of research work at a university is more often undertaken for its own sake.[28] A larger post-graduate enrolment may follow as a consequence rather than act as a cause.

Since the amount of research work to be undertaken by Canadian universities in the future will be so largely governed by policy decisions, there seems little sense in attempting to forecast the associated capital requirements on a separate set of assumptions. One should merely bear in mind the likelihood of a growing emphasis on research and allow this to influence the selection of a cost-per-student factor.

Authorities of three universities now embarked on major physical expansion have made available estimates which would tend to support the view

[27]Relative, i.e., to the expected increase in enrolment.

[28]". . . although a handsome donation may help to precipitate the decision.

that the cost per student of new facilities is likely to be well over $4,000. At the Newfoundland Memorial University in St. John's, it is the intention to build an arts and administration building, a science and engineering building (only the first two years of engineering will be given), a library, a gymnasium and swimming pool, and a boiler house with a grounds department building and conservatory attached. The whole project is expected to cost upwards of $6,500,000 and is designed to accommodate a normal enrolment of 1,200 students in arts, commerce, education, science, and the first two years of engineering. The cost per student would thus work out to about $5,400. Two qualifications should be made. The first is that owing to heavy freight charges, capital works of the kind described may cost as much as 25% more in Newfoundland than they would in Montreal or Toronto. On the other hand, the project is not designed to provide all capital requirements: further facilities will be added later on.

Buildings and equipment on the new Laval University campus at Quebec will be worth an estimated $51 million when all the buildings now projected have been constructed.

Included in this figure are the following:

School of forestry	$ 1,978,000
School of commerce	2,465,000
School of medicine	4,500,000
School of theology	5,000,000
School of science and engineering	8,000,000
School of household science	600,000
School of dentistry	1,500,000
School of education	600,000
School of social sciences	700,000
School of nursing	600,000
School of philosophy and letters	2,000,000
Central library	2,000,000
University hospital	11,500,000
Four student residences	5,200,000
Workshops	1,000,000
School of pharmacy and other facilities	3,357,000
Total	$51,000,000

The highest current forecast of enrolment at Laval by the time the aforementioned buildings have been completed is 7,000 students. The cost per student would thus seem to be about $7,300, or $4,900 if the hospital and school of theology are omitted.[29] Actually, it is thought that the new plant

[29]Hospitals are, of course, dealt with in Chapter 4. As for the school of theology, its omission here seems wise because a large part of the proposed building will be used for non-instructional purposes.

will be able to accommodate appreciably more than 7,000 students without undue strain.

Carleton University in Ottawa furnishes another instance of the planning of an entirely new campus. At the end of the first stage of expansion, buildings and equipment worth an estimated $5 million will have been provided for an expected enrolment of up to 1,000 students. This would imply a cost-per-student factor of $5,000. Initially at least, Carleton will not provide as wide a range of facilities as would a larger university. (The same may be said of Newfoundland Memorial University.)

A cost-per-additional-student factor may be derived from the forecast of the capital requirements of the University of Manitoba contained in the Province of Manitoba brief to the Royal Commission. A range from $4,856 to $5,623 is indicated.[30]

A simple average of the above four estimates (leaving out Laval's hospital and school of theology) yields a figure of just under $5,135 per student. At this point, some of the factors which may tend to increase cost per student in the future should be recalled—notably the likelihood of a trend toward more residence accommodation and the probability of an increasing emphasis on research. Having regard to these, one would perhaps be justified in edging up to, say, $5,500 per student as a national average. Larger universities may spend rather more, junior colleges and smaller universities rather less.[31]

As in the case of schools, it might be thought desirable to make some provision for the reduction of crowding. Some faculties of some universities today suffer from crowding; however, the cost of remedying this is likely to bulk relatively small beside the cost of accommodating increased enrolment.

School and University Requirements: Conclusion

It remains only to calculate university requirements in dollars and to summarize them together with the forecast requirements of elementary and secondary schools.

The staggered pattern of peaks may be observed: expenditure on elementary schools is expected to be at its highest between 1954-55 and 1959-60; the secondary school peak will follow; and finally, between 1964-65 and 1969-70, expenditure on universities may reach its maximum for the period.[32]

The forecast has been built up on a national basis and, for a number of reasons, lends itself even less to a regional breakdown than do most of the

[30] *Prospects for Development in Manitoba*, a submission presented to the Royal Commission by the Province of Manitoba, p. 121. There are some special features in the Manitoba situation, e.g., the planned transfer of two affiliated colleges to the main campus.

[31] No attempt is made to calculate university replacement expenditure. Permanent university buildings seem to have a longer life than schools. Some universities plan to spend substantial amounts on the replacement of army-type huts and other temporary structures.

[32] It is here assumed that school and university facilities will be constructed as needed. In practice, most school and university authorities strive to anticipate needs to some extent. For instance, in an area where an enrolment "bulge" is seen to be moving through the elementary schools, allowance for this may be made in the planning and construction of a new high school.

Table 29

FORECAST OF SCHOOL AND UNIVERSITY CAPITAL REQUIREMENTS

(millions of 1955 dollars)

Period	Elementary schools	Secondary schools	Universities and colleges	Total
1954-55 to 1959-60	502	295	146	943
1959-60 to 1964-65	380	365	217	962
1964-65 to 1969-70	236	312	272	820
1969-70 to 1974-75	254	217	257	728
1974-75 to 1979-80	353	224	207	784
Total	1,725	1,413	1,099	4,237

forecasts in the study. Certain regional cost differentials are likely to persist. The migration patterns of university students, many of whom attend universities in provinces other than their own, are peculiarly difficult to foresee. Persons desirous of having forecasts of school and university expenditure in particular provinces would be well advised either to consult provincial briefs to the Royal Commission or to start from scratch and construct forecasts of their own.

It may be of interest, however, to note that if the total forecast of expenditure on schools and universities is allocated to regions in accordance with the expected increases in provincial populations, the following result is obtained:

Table 30

FORECAST OF SCHOOL AND UNIVERSITY CAPITAL REQUIREMENTS ALLOCATED TO REGIONS IN ACCORDANCE WITH EXPECTED INCREASES IN PROVINCIAL POPULATIONS

(millions of 1955 dollars)

Province or region	1954-55 to 1979-80
Atlantic	229
Quebec	1,335
Ontario	1,697
Prairies	511
British Columbia	465
Total	4,237

6

ROADS AND STREETS

SINCE THE DAYS of the first permanent European settlement, there have been roads of some sort in Canada. Quite early in the history of New France, roads began to be required as portages, as a winter alternative to water routes, and as a means of access from farms to lakes and navigable rivers. With the growth of the colony and the spread of settlement away from the immediate vicinity of the St. Lawrence, the need for land transport increased, and a number of more ambitious projects were undertaken. By 1763, Montreal and Quebec had been linked by road, and there were other routes of more than local significance.[1]

Notwithstanding the continued predominance of water transport, road-building remained a relatively important activity of governments until well into the Victorian era. With the coming of the railway, however, roads gradually slipped back into what was mainly a local role, not to emerge again until the automobile revolution of the twentieth century.[2]

To say of that revolution that even today its implications have not yet been fully grasped is undoubtedly to utter a commonplace. It is, however, an unavoidable commonplace in any discussion of roads and road transport. Although there are now in the neighbourhood of four million motor vehicles registered in Canada, there is a surprising lack of information on the movements of those vehicles and on the adequacy of the present road network to support them. Only rather recently has the planning and construction of roads begun to move decisively away from the piecemeal and often politically tainted localism of earlier times toward the comprehensive development of complete road systems based on the scientific analysis of traffic flows and highway capacities.

As for the wider implications of the automobile—its impact on the shape of cities and on the whole pattern of urban and rural life—these are still

[1]Dubé, Y., *Les Problèmes Administratifs de la Voirie dans la Province de Québec,* mémoire présenté à la Commission Royale d'Enquête sur les Problèmes Constitutionnels par l'Union des Municipalités de la Province de Québec, Québec, 1955, pp. 5-7.

[2]See Canadian Tax Foundation, *Taxes and Traffic: A Study of Highway Financing,* Toronto, 1955, pp. 3-6. This is, of course, a prime reference for any study of highway problems in Canada.

very much in the process of working themselves out, and it would be a rash person indeed who would undertake to predict the final outcome with any degree of certainty.

Some indication of the relative importance of roads in the long-distance transportation picture is given in another study for the Commission.[3] It is estimated that in 1953, some 13% of total intercity revenue freight ton-miles were accounted for by highway transport, compared with 61% by railways, 20% by water carriers, and 6% by pipelines.[4] (In terms of value, the highway percentage would doubtless have been a good deal higher, since it is a characteristic of the trucking industry that it tends to concentrate on the carriage of goods which have a relatively high ratio of value to weight.) In the passenger field, private cars accounted for nearly 79% of total intercity passenger miles, and buses for another 7%, leaving 11% to railways and 3% to scheduled and non-scheduled airlines.[5]

To assess road transport purely in terms of intercity traffic is, however, to miss a great part of its significance. The brief submitted to the Royal Commission by the Province of Ontario contains a most useful description of road traffic in terms of what might be called "degrees of essentiality":

> " . . . Motor trucks and other commercial vehicles form what may be called the hard core of road traffic for which there is no known substitute. They are the freight carriers of local trade, just as trains and cargo vessels are the freight carriers in the commerce of nations. The whole of the immense tonnage of agricultural produce is moved away from the farms entirely by way of local roads. The millions of tons of coal and oil used as household fuel in towns and cities must be delivered to the consumer by road transport, while construction materials, which are among the heaviest articles of commerce, must be handled in similar fashion. Again, all the food, clothing and other merchandise bought in retail shops must first be delivered to merchants by road transport.
>
> "Thus, it is no exaggeration to say that the whole flow of merchandise into consumption, however far it may have come by sea or rail, must also travel at least once or twice over local roads before it reaches its final destination in the hands of the consumer . . . ."

(Mention is also made of essential non-commercial movements such as those of ambulances, fire engines and police cars.)

[3] *Transportation in Canada*, a study prepared for the Royal Commission by J-C. Lessard, pp. 90 and 122.

[4] The share of air freight carriers was less than 0.5%, although, as in the case of trucks, the value share was almost certainly larger.

[5] Revenue flights only.

> "Part of the daily movement of passenger autos is likewise indispensable. It includes a substantial part of the passenger vehicles on the roads, such as those of farmers and other country and suburban dwellers, commercial travellers and others whose occupational needs cannot be met by buses or various forms of rail transport. . . .
>
> "The remaining demand for highways comes from other quarters, and is more variable. For many persons who live within towns and cities and do not employ a vehicle in making a living, the ownership of a passenger car is to some degree optional and the extent to which it is used varies greatly, depending on the adequacy of public transportation.
>
> "There are some types of passenger movement in private cars for which buses and trains do not offer an effective alternative. These comprise various types of traffic which fan out over a large area at one end, or both ends, of a busy main route. Such is traffic movement between the market towns and the farms: it proceeds part of the way from town by main routes and then gradually scatters over the vast mileage of township roads. Some of the traffic from large cities to their more distant suburbs is of the same kind. Such, too, is the movement to northern holiday resorts in the summer, where traffic proceeds over densely travelled roads for 25, 50 or 100 miles and then spreads out over a great number of subsidiary roads. . . ."[6]

Clearly, a nation's road network has to meet a very complex kind of demand.

In considering some of the principal factors which have operated to change both the nature and the magnitude of this demand over the last few decades, one naturally turns first to changes in the number of motor vehicles in use. Ever since the automobile first became an important means of transportation, the rise in vehicle registrations in Canada has been almost continuously surprising. Even in the late '30's, hardly a period of roaring prosperity, the annual net increments were fairly substantial, while the increase since the Second World War has outstripped all the best guesses of 1945. Some of the increase can be attributed to population growth, but a more important factor has been the rise in the percentage of people owning cars, together with the increasing use of commercial motor transport. What may be called the population/vehicle density—the number of persons per motor vehicle—had reached 4.2 by 1954, compared with 7.8 in 1939 and 8.3 in 1930.[7]

[6] *Submission of the Province of Ontario to the Royal Commission*, pp. 77 and 78.

[7] A preliminary estimate indicates that the ratio in 1955 was 4.0. The number of persons per *passenger car* was 5.3 in 1955 (preliminary), 5.7 in 1954, 9.5 in 1939, and 9.7 in 1930.

Another ratio of importance in relation to road demand is the proportion of commercial vehicles to total vehicles. This rose from 13.6% in 1930 to 16.5% in 1939 and 25.9% in 1952. There has since been a slight decline; but the increase over the longer period is significant inasmuch as commercial vehicles are generally heavier than ordinary cars and impose a greater strain on highways.

Table 31

MOTOR VEHICLE REGISTRATIONS IN CANADA

(selected years)

	Total vehicles (000)	Commercial vehicles[a] (000)	Commercial vehicles as percentage of total	Persons per motor vehicle
1903	.2	–[b]	.0(?)	28,255.0
1915	95.3	.5[b]	.8(?)	83.7
1918	276.9	9.6[b]	5.5(?)	29.4
1930	1,232.5	167.5	13.6	8.3
1933	1,083.2	156.2	14.4	9.8
1935	1,176.1	175.9	15.0	9.2
1939	1,439.2	236.9	16.5	7.8
1945	1,497.1	322.8	21.6	8.1
1951	2,872.4	731.6	25.5	4.9
1952	3,155.8	817.3	25.9	4.6
1953	3,430.7	876.7	25.6	4.3
1954	3,644.6	918.5	25.2	4.2[c]

a Includes buses, convertible trucks, road tractors, ambulances, etc., but excludes livery and taxi cabs and motor-cycles, all of which are included in "total vehicles".

b Some provinces reported total vehicles only. The figures for commercial vehicles may therefore be too low.

c As might be expected, this ratio varies considerably from province to province. In 1954, provincial populations per motor vehicle registered were: Newfoundland, 11.6; Prince Edward Island, 5.0; Nova Scotia, 5.1; New Brunswick, 5.5; Quebec, 6.5; Ontario, 3.4; Manitoba, 3.9; Saskatchewan, 3.3; Alberta, 3.1; British Columbia, 3.4; Yukon and Northwest Territories, 5.4.

SOURCES: *Taxes and Traffic: A Study of Highway Financing*, Canadian Tax Foundation, Toronto, 1955; and *The Motor Vehicle* (annual), Dominion Bureau of Statistics.

Account must also be taken of how far, on the average, motor vehicles are driven each year. The greater the use made of cars and trucks, the greater is the burden on the road system. It is estimated that average annual travel per vehicle in the Province of Ontario rose from 6,600 miles in 1931 to 8,610 miles in 1954, although with wartime gasoline rationing and other influences, the rising trend was by no means a smooth one.

The combination of these three factors—the increasing number of vehicles, the increasing use made of them, and the growing proportion of commercial vehicles in the total — together, of course, with such other influences as higher speed, public insistence on safer and better roads, the growing tendency to keep roads open winter and summer and, not least, the rise in the general level of prices, has brought about a multiplication of expenditure on roads and streets over the last three and a half decades. Sub-

Table 32

ESTIMATED VEHICLE TRAVEL IN ONTARIO

	Net gasoline tax gallonage (thousands of gallons)	Miles per gallon factor	Total vehicle miles of travel (millions of miles)	Average travel per vehicle (miles)
1931	222,595	16.56	3,686.2	6,600
1932	217,913	16.56	3,608.6	6,840
1933	212,419	16.56	3,517.6	6,820
1934	232,776	16.56	3,854.8	7,170
1935	245,450	16.56	4,064.6	7,260
1936	264,514	16.56	4,380.3	7,490
1937	300,485	15.36	4,615.4	7,450
1938	310,225	16.61	5,152.8	7,760
1939	317,314	16.51	5,238.8	7,730
1940	332,199	16.55	5,498.0	7,870
1941	345,765	16.50	5,705.1	7,780
1942	282,029	16.14	4,551.9	6,420
1943	232,008	15.55	3,607.7	5,270
1944	242,805	15.50	3,763.5	5,620
1945	288,401	15.66	4,516.4	6,870
1946	398,856	15.98	6,373.7	9,050
1947	427,384	15.83	6,765.5	8,590
1948	468,667	15.73	7,372.1	8,550
1949	520,762	15.76	8,207.2	8,580
1950	581,146	15.76	9,158.9	8,400
1951	642,218	15.73	10,102.1	8,480
1952	691,014	15.73	10,869.6	8,500
1953	773,403	15.73	12,165.6	8,730
1954	824,522	15.43	12,722.4	8,610

SOURCE: *Prediction of Traffic in Ontario*, Planning and Design Branch, Department of Highways, Province of Ontario, Toronto, 1955.

ject to the reservations noted below,[8] the figures of Table 33 would indicate an increase in expenditure on highways and rural roads from $22 million in 1919 to nearly $430 million in 1954. The annual amounts spent dropped off during the Great Depression and again during the Second World War, but the trend over the longer period is obvious enough.

[8] The Dominion Bureau of Statistics at present publishes two series on road and street expenditure: one contained in *Construction in Canada*, and the other in *Highway Statistics*, both appearing annually. The figures of construction expenditure on roads and streets given in Chapter 1, Table 2, are drawn, like the figures relating to other types of construction, from *Construction in Canada*. In dealing specifically with roads and streets, however, it was deemed better to switch to *Highway Statistics*, first, because the figures are classified into urban and rural categories and, second, because most previous work in the field, notably that of *Taxes and Traffic*, has been based on *Highway Statistics*.

The coverage of these figures has improved greatly over the years. There are still, however, believed to be some gaps, particularly with respect to municipal expenditure. The aggregate size of these gaps has been estimated at possibly 10% of total expenditure. (*Taxes and Traffic*, p. 16).

One cannot say that the *Highway Statistics* series is better than the *Construction in Canada* series, or vice versa. They are simply two different series based on different reporting and, in some areas, on different samples. It is hoped eventually so to organize the series that they may both be derived from the same source data. In the meantime, it may be noted that so far as new construction is concerned, the *Construction in Canada* series has indicated rather higher expenditure than the *Highway Statistics* series.

New Construction Expenditure, Roads and Streets
(millions of dollars)

	Construction in Canada series	*Highway Statistics* series	*Highway Statistics* series, plus 10%
1951	259.1	229.3	252.2
1952	334.0	284.8	313.3
1953	292.8	284.6	313.1
1954	321.5	278.8	306.7
1955	384.0p	n.a.	n.a.
1956	473.7e	n.a.	n.a.

p Preliminary
e Estimated.

Table 33

EXPENDITURE ON HIGHWAYS, ROADS AND STREETS IN CANADA[a]

(millions of dollars)

	(1)	(2)	(3)		(4)	(5)	(6)
	Expenditure on highways, rural roads[b]	Expenditure on urban streets[c]	Total expenditure	of which:	Construction[d]	Maintenance[d]	Other[d]
1919.....	22.2	n.a.	(22.2)		(15.3)	(7.0)	—
1920.....	37.7	n.a.	(37.7)		(27.4)	(10.2)	—
1921.....	52.6	n.a.	(52.6)		(39.8)	(12.8)	—
1922.....	50.0	n.a.	(50.0)		(37.7)	(12.1)	—
1923.....	56.1	n.a.	(56.1)		(42.0)	(13.8)	—
1924.....	45.1	n.a.	(45.1)		(30.7)	(14.3)	—
1925.....	48.4	n.a.	(48.4)		(33.1)	(15.3)	—
1926.....	44.9	n.a.	(44.9)		(29.5)	(15.5)	—
1927.....	59.4	n.a.	(59.4)		(40.2)	(18.9)	—
1928.....	71.8	n.a.	(71.8)		(48.5)	(23.3)	—
1929.....	80.8	n.a.	(80.8)		(57.0)	(23.8)	—
1930.....	96.4	n.a.	(96.4)		(69.6)	(26.4)	—
1931.....	79.0	n.a.	(79.0)		(55.2)	(23.9)	—
1932.....	61.9	n.a.	(61.9)		(41.9)	(20.1)	—
1933.....	44.4	n.a.	(44.4)		(30.1)	(14.1)	—
1934.....	87.0	n.a.	(87.0)		(64.5)	(22.7)	—
1935.....	59.5	10.8	70.3		42.6	26.8	0.9
1936.....	68.6	11.4	80.0		49.8	29.5	0.7
1937.....	94.4	12.2	106.6		72.3	30.4	3.9
1938.....	103.0	14.5	117.5		79.9	33.1	4.5
1939.....	92.1	14.4	106.5		66.5	35.7	4.3
1940.....	102.9	12.9	115.8		66.3	43.7	5.8
1941.....	77.0	12.2	89.2		41.0	44.9	3.3
1942.....	61.2	12.0	73.2		29.5	40.9	2.8
1943.....	65.4	12.6	78.0		27.2	47.3	3.5
1944.....	71.9	15.5	87.4		35.3	48.1	4.0
1945.....	84.2	19.4	103.6		37.7	61.5	4.4
1946.....	144.5	24.6	169.1		90.5	71.5	7.1
1947.....	232.5	34.5	267.0		140.9	115.1	11.0
1948.....	265.8	40.6	306.4		172.9	119.2	14.3
1949.....	270.2	49.0	319.2		184.1	122.7	12.4
1950.....	284.4	53.1	337.5		186.1	135.7	15.7
1951.....	334.6	64.8	399.4		229.3	151.7	18.4
1952.....	404.3	71.3	475.6		284.8	174.7	16.1
1953.....	397.1	83.0	480.1		284.6	177.1	18.4
1954.....	429.5	93.0	522.5		278.8	217.0	26.7

a See note on preceding page.

b Includes expenditure on rural bridges and ferries.

c Includes expenditure on sidewalks, bridges and culverts. The figures relate to cities and towns of 2,000 population and over in N.S. and N.B.; of 4,000 and over in Quebec and Ontario; of 1,000 and over in the four western provinces and Newfoundland; and all municipalities in P.E.I.

d Column 6 includes administration and other expenditures not allocated to either construction or maintenance. Prior to 1937, all expenditures on highways and rural roads were designated as either construction or maintenance. Discrepancies between column 3 and the sum of columns 4 and 5 in years prior to 1935 are due to rounding of figures.

SOURCES: Canadian Tax Foundation, *op. cit.* and *Highway Statistics* (annual), Dominion Bureau of Statistics.

Table 34

ROAD AND STREET MILEAGE IN CANADA

	Total mileage (000)	Surfaced mileage (000)	Paved mileage (000)	Vehicles per surfaced mile	Vehicles per paved mile
1. Highways and rural roads					
1922	385.4	48.7	0.9	10.5	566.0
1930	394.0	82.1	3.8	15.0	324.3
1933	409.3	95.0	5.3	11.4	204.4
1939	498.1	114.5	13.6	12.6	105.8
1945	552.0	131.5	17.3	11.4	86.5
1951	511.9[a]	175.4	26.3	16.4	109.2
1952	512.8[a]	181.3	28.6	17.4	110.3
1953	517.8[a]	191.0	30.7	18.0	111.7
1954	524.1[a]	192.6	33.3	19.0	109.4
2. Urban streets					
1935	11.0	8.0	3.8		
1939	13.0	8.9	4.3		
1945	14.2	9.9	6.3		
1951	14.9[b]	11.4	7.7		
1952	15.2	12.2	8.1		
1953	15.9	12.8	8.6		
1954	15.9	13.1	9.3		
3. Total highways, roads and streets					
1935	421.8	104.4	10.7	11.3	109.9
1939	511.1	123.4	17.9	11.7	80.4
1945	566.2	141.4	23.6	10.6	63.4
1951	526.8	186.8	34.0	15.4	84.5
1952	528.0	193.5	36.7	16.3	86.0
1953	533.7	203.8	39.3	16.8	87.3
1954	540.0	205.7	42.6	17.7	85.6

a Excludes miles of unimproved road allowance not in use in Saskatchewan.

b Excludes Newfoundland.

SOURCES: For years prior to 1951, *Taxes and Traffic: A Study of Highway Financing*, Canadian Tax Foundation, Toronto, 1955; for later years, *Highway Statistics* (annual) and *The Motor Vehicle* (annual), Dominion Bureau of Statistics.

Information on urban street expenditures does not extend as far back, but the amount of just under $11 million spent in 1935 may be compared with expenditure of $93 million in 1954.

The relative amounts spend on construction[9] and maintenance[9] have varied somewhat over the years. In the late '30's, construction sometimes accounted for more than two-thirds of total road and street expenditure. During the war the emphasis was on maintenance, with construction cut back. More recently, construction has run between 50% and 60% of total expenditure.

[9]Construction here includes not only the building of new roads, but major improvements and widening and all work which significantly prolongs the life of a road. Maintenance includes routine repairs, minor improvements, cleaning, snow-clearing, sanding, etc. Other definitions are sometimes used. It should be noted that a bold construction programme, much of which is, in fact, reconstruction, may have the effect of reducing total maintenance charges, at least for a time. A newly rebuilt road will need less patching, etc.

The increase in the amount spent on construction has not been reflected in an equivalent increase in aggregate road mileage. The total mileage of highways and rural roads has not so much as doubled since 1922.[10] The really significant growth has been in paved and otherwise surfaced mileage. Total surfaced mileage, including that of urban streets, has about doubled since 1935; paved mileage has quadrupled. It is hardly necessary to add that the standard and consequently the cost of new paved roads has moved upward over the period. A modern two-lane highway built to Trans-Canada specifications is heavier, wider, and straighter than its typical 1935 counterpart and for that reason alone costs a great deal more to produce.

How much of the rise in road and street expenditure should be attributed purely to price increases is difficult to say, owing to the lack of a deflator specifically applicable to roads. The so-called "implicit price deflator" for new non-residential construction, a by-product of national accounts statistics, is perhaps the most relevant Canadian series available. Applying this to column 4 of Table 33 would suggest that, in terms of constant 1949 dollars, annual construction expenditure on roads and streets rose from an average of $108 million in 1935-39 to $165 million in 1946-50 and $210 million in 1951-54. In other words, real construction expenditure in the early '50's would seem to have been a little less than double what it was in the late '30's.

Examination of American price indices suggests that pure highway construction costs may not have risen as much as construction costs in general.[11] In column 2 of Table 35, an attempt is made to allow for this by using an adjusted deflator. The result would indicate a rise in real construction expenditure from $100 million in 1935-39 to $164 million in 1946-50 and $227 million in 1951-54.

Road Deficiencies and Road Needs

It will be a matter of common observation to most people, particularly if they drive cars in or near any of the larger metropolitan centres, that the existing Canadian road and street network leaves much to be desired in relation to present-day traffic loads. Repeated public opinion polls have shown majorities of car-owners and non-car-owners alike in agreement that highways and main roads are not as good as they ought to be,[12] and it may be safely presumed that expert opinion would be even more heavily condemnatory.

The principal costs and disadvantages of inadequate roads have by now been widely publicized. The most serious cost is indubitably that in human lives and injuries. Granted that all drivers should use judgment and adjust their speed to conditions and that few accidents can be directly blamed on

[10]See Table 35.
[11]See Appendix VI.
[12]Canadian Tax Foundation, *Taxes and Traffic*, p. 99.

Table 35

ROAD AND STREET CONSTRUCTION EXPENDITURE

(in constant 1949 dollars)

	In millions of 1949 dollars		In 1949 dollars per vehicle registered	
	(1) Using implicit price deflator, non-residential construction	(2) Using implicit price deflator adjusted	(3) Using implicit price deflator, non-residential construction	(4) Using implicit price deflator adjusted
1935	79.0	64.6	67	55
1936	90.1	74.1	73	60
1937	121.1	111.1	92	84
1938	136.6	137.0	98	98
1939	115.1	114.3	80	79
1940	110.5	113.1	74	75
1941	64.8	62.0	41	39
1942	43.4	34.7	28	23
1943	38.4	28.2	25	19
1944	49.0	39.5	33	26
1945	52.1	45.1	35	30
1946	118.0	107.5	73	66
1947	165.0	161.2	90	88
1948	179.7	174.8	88	86
1949	184.1	184.1	80	80
1950	175.9	192.5	68	74
1951	193.0	204.9	67	71
1952	224.0	232.3	71	74
1953	214.6	230.8	63	67
1954	210.1	238.9	58	66

SOURCES: Construction expenditure, as for Table 33.
Price deflators, see Appendix VI.

roads, the fact remains that the death rate on high-type, heavily-travelled modern arteries is only a fourth to a half as high as it is on less adequate highways.[13]

Then there are money costs—the direct costs occasioned by rough roads and traffic delays[14] and the more hypothetical costs of diverting to less suitable means of transport traffic which would otherwise have gone by road. Nor should defence considerations be forgotten: an inadequate highway system would be a grave disadvantage in the event of war.

So much for the obvious. But what is road adequacy, and how may it be measured? One might say simply that a particular stretch of road was

[13] *A 10-Year National Highway Program*, the President's Advisory Committee on a National Highway Program (Clay Committee), Washington, 1955, p. 9. Care should be taken to relate accident numbers to traffic flows. People will often complain that there are just as many accidents on a new four-lane highway as there were on the road it replaced; however, it will generally be found that the new road is carrying a great deal more traffic than the old one and that an individual traveller's chances of being killed or hurt have been importantly reduced.

[14] An Iowa study showed that the average cost of operating a passenger car was eight cents a mile on earth roads, five cents a mile on gravel roads, and 3.5 cents a mile on paved roads. (*Taxes and Traffic*, p. 118.) The cost of traffic congestion in Manhattan has been estimated at more than $500 million a year. (Rapkin, Chester, "Some Effects of Economic Growth on the Character of Cities", *American Economic Review*, May 1956, p. 297.)

adequate if it could accomodate, safely and at a reasonable rate of speed, all the traffic which wanted to use it. But to measure the extent to which an entire road system falls short of this ideal is something else again.

Some pointers to inadequacy may be derived from the statistical material already presented. Thus, Table 34 would indicate that the extension of paved and otherwise surfaced roads since 1939 has not kept pace with vehicle registrations: there are now more vehicles per mile of surfaced road and per mile of paved road than there were just before the war. This is probably not very conclusive evidence so far as paved roads are concerned, since the average capacity of such roads has almost certainly moved up somewhat with the extension of multilane highways and the improvement in design standards for new two-lane ones.

A possibly stronger indication of deficiency is provided by columns 3 and 4 of Table 35, where the two estimates of road and street construction expenditure in constant dollars are divided by vehicle registrations. In column 3, expenditure per vehicle in 1949 dollars moves from an average of $82 in the period 1935-39 to $80 in 1946-50, then drops to only $65 in 1951-54. In column 4, the corresponding figures are $75 in 1935-39, $79 in 1946-50, and $70 in 1951-54.[15] In both columns, there is a distinct decline after 1947, which suggests that having just got to grips with the wartime construction backlog, authorities were then confronted with the swift post-war rise in the vehicle population.

Such crude, over-all measures of inadequacy are, however, of very limited significance. The most pernickety motorist would concede that there are many thousands of miles of road and street in Canada which are reasonably adequate for the job they have to do. The really crucial traffic problems are localized in both time and space. The great bulk of them occur in or near large centres of population, and they tend to occur at certain times of day or on certain days of the week or year. Such are the jams associated with urban rush hours and the mass exodus to holiday resorts on long summer week-ends.

It follows that a really meaningful assessment of a road system must begin by being particular rather than general. The so-called needs studies undertaken in several states of the United States by the Automotive Safety Foundation are examples of the kind of detailed, comprehensive work that is required.[16] First, the road system is broken down into its main functional components. Then each of these components is assessed in the light of established engineering criteria on the one hand (width of road, width of shoulder, curvature, gradient, sight distance, etc.), and of recorded traffic flows on the

[15]A decline in this figure could indicate sufficiency as well as deficiency. Which interpretation is chosen really depends on the other evidence available.

[16]See, for example, *A Factual Study of Highway Needs in West Virginia*, Automotive Safety Foundation, 1954.

other. It then becomes possible to say just where the existing system seems deficient and to estimate the cost of correction. If to this result is linked a prediction of future traffic, an attempt may be made to forecast highway expenditure for some years ahead.

A study of this sort has been under way for some time in Ontario; unfortunately, the results will not be available in time to be incorporated in the present report. Preliminary surveys have indicated the existence of a total construction backlog in the province of just under $1,750 million—$920 million on provincial highways, $230 million on county and township roads, and more than half a billion dollars on urban streets.[17]

In the meantime, efforts are being made to obtain acceptance of a standard functional classification for Canadian roads and streets. This would, of course, be of great assistance in making road statistics more informative and in preparing the way for future needs studies. The proposed classification is summarized in Table 36.

Table 36

PROPOSED ROAD AND STREET CLASSIFICATION

Class	Definition
Rural Roads	
1. Primary Highways	Provincial, interprovincial and international routes of provincial or national importance. Such highways normally serve large volumes of intercity traffic or connect important economic regions.
2. Secondary highways	Routes connecting smaller communities or feeding primary highways.
3. Local roads	Roads providing access to rural properties and serving traffic essentially local in character. Service roads within special areas, such as provincial or national parks and Indian reservations.
4. Development roads	Roads to open up undeveloped areas, such as mining, forest or tourist regions. The justification for these roads is based on the prospective economic development of the area.
Urban Streets	
1. Primary highway connections	Urban routes designated as connections of primary highways.

[17] *Submission of the Province of Ontario to the Royal Commission*, p. 82.

Table 36 (Continued)

2. Secondary highway connections	Urban routes designated as connections of secondary highways.
3. Major urban thoroughfares	Streets other than designated highway connections connecting major sections of an urban area.
4. Local streets	All other streets.

SOURCE: *Road and Street Classification*, p. 7, Canadian Good Roads Association.

Table 36 would suggest, among other things, that quite apart from the question of backlog there are really several different road problems to be faced. There is the problem of providing ordinary local streets in new subdivisions—a problem in many ways more closely associated with housing and industrial growth than with increasing traffic. Access, rather than the accommodation of swift flows of vehicles, is the main objective here. There is also the problem of providing farmers with all-weather roads by which they may drive to town to buy or sell or to amuse themselves; there is the problem of opening up new natural-resource areas through the medium of development roads; there is the problem of providing high-speed main arteries, with appropriate feeders, to handle massive movements of goods and people between major cities and economic regions; and, finally, there is the urban traffic problem, which is a problem of roads and of a great deal else besides.

It requires no particular prescience to foresee that the last two problems will be the most acute and that the *sine qua non* of any attempt to guess at the magnitude of future road expenditure is a forecast of traffic. At the same time, it is to be expected that roads of the development type will receive new emphasis as northern areas are opened up. Nor can it be presumed that the further decline of the farm population in many districts will occasion a lessened need for market roads: experience in Saskatchewan suggests that the opposite may be the case.[18] There may be fewer farmers, but the large-scale, mechanized nature of their operations and the desire for companionship and urban-type amenities, may lead them to use the roads more than they do today. In all the principal categories of road expenditure, the outlook would seem to be for at least some upward movement.

Some Trends in Highway Construction

As in the past, the most significant physical change in the highway and rural-road network in the future will almost certainly be in its quality rather than in its aggregate mileage. The average cost per mile of new intercity and interregional arteries is likely to rise considerably; at the same time, their ef-

[18] See *Rural Roads and Local Government*, Province of Saskatchewan, Royal Commission on Agriculture and Rural Life, Regina, 1955, p. 56 et al.

fective capacity per mile will also increase, and it may be hoped that with better planning and location of routes the highway construction dollar will come to provide a substantially greater amount of actual transportation service. Regardless of this, the more traffic grows, the more emphasis will tend to fall on "high-type" roads, capable of accommodating very large flows of vehicles.[19]

The multilane, divided-strip highway, by-passing towns along its route and intersecting other roads through the medium of grade separations, thus promises to become more common, if far from universal. But however many lanes new highways have—whether two, four, six, or more—one of the most important changes is likely to be the stricter control of access, an aspect of highway construction described in the Clay Report as fundamental.[20] Given one major resurfacing, a well-built highway may not wear out physically for perhaps 30 years. But it may become functionally obsolete long before that if its effective capacity is steadily frittered away by the proliferation of abutting structures, each with its individual access road or driveway. The time would seem to have passed when major highways could be expected to do double duty as both through and local roads. If only to protect their very expensive investments, highway authorities will come more and more to insist on the restriction of access and to provide for installations such as service stations and motels by means of parallel service roads joining the main route at suitably protected intersections.

The element of land cost may bulk somewhat larger in future highway expenditure. In the '20's, the great task was to make the country road system passable to motor vehicles; and much of the construction of that period consisted in applying surfaces to existing roadbeds.[21] Later, as the weight, number, and speed of vehicles increased, more thoroughgoing practices had to be adopted: drainage had to be improved, curves and hills reduced or eliminated, driving surfaces widened. Even so, it was often possible to adhere largely to the existing right-of-way.

But with the modern highway, it is frequently necessary to strike out anew. To provide full-width shoulders, adequate sight distance and divider strips, where appropriate, requires a great deal of land. The fringes of the old highway may be so built-up in places as to make the cost of widening the right-of-way by purchase or expropriation prohibitive; or again, the route followed by the old road may simply render it unamenable to further improvement except at unjustifiable expense. The decision may then be made to acquire a complete new right-of-way.

[19]It has been demonstrated that a good four-lane dual highway can carry three to four times the load of a two-lane highway. (Canadian Tax Foundation, *op. cit.*, p. 100.)

[20]President's Advisory Committee on a National Highway Program, *op. cit.*, p. 12.

[21]Owen, Wilfred, *Automotive Transportation*, the Brookings Institution, Washington, 1949, p. 40.

Urban Traffic

In some of its broad characteristics, the urban traffic problem considerably antedates the automobile. London was driven to build its first underground well before the invention of the internal combustion engine, and it is known that traffic jams reached serious proportions in ancient Rome. Throughout their history, and regardless of the means of locomotion employed, cities have tended to generate large volumes of traffic within themselves and to draw traffic from outside. At the same time, the very concentration of population and business activity which has attracted and generated traffic has meant, first, that streets must compete with buildings for scarce and expensive land and, second, that once laid out, they are extremely difficult to alter. What the automobile has done, in essence, has been greatly to exacerbate the problem and to spread it over a wider area.

The assertion is often made that streets laid out in the age of the horse and buggy are unsuited to motor traffic. In the older cities of eastern and central Canada, in particular, downtown streets tend to be narrow. Mere wideness, however, is no guarantee of a smooth traffic flow, as many western cities have found; and it is probably true to say that the inadequacy of existing streets derives at least as much from their pattern as from their mean width. The traditional North American grid system is a great convenience to surveyors, deliverymen, and out-of-town visitors in search of strange addresses; it has few other merits. For one thing, it ensures a large number of intersections. For another, it so often fails to take proper account of topographical features which, had they been respected, would have proved less of an impediment to movement and at the same time made for a more interesting appearance. Finally, it makes nearly every street potentially or actually a through street. This means that what should be local streets must be built to more expensive standards than would otherwise be necessary, and that "quiet" residential districts, particularly older ones near the centre of the city, are forever in danger of being invaded by clamorous streams of vehicles seeking to avoid some bottleneck.

As in the case of highways, one of the chief troubles with many streets is that they are called upon to do too many different things at once. Who does not know those long streets leading out of cities, which combine the functions of highway connections, urban arteries and secondary commercial districts, and which, at 5:30 in the evening, present a mad confusion of homing office and factory workers, belated shoppers trying to park, and outward-bound trucks and buses with schedules to meet? A proper specialization of function would seem even more desirable for urban streets than it is for highways and rural roads.

The attack on the urban traffic problem has broadened as the problem itself has grown. In the early days of the automobile, the main effort, within cities as without them, was directed toward making streets passable to motor

vehicles and regulating movement at a few key intersections. As traffic density increased, regulation was extended: through streets were designated, traffic lights and stop signs erected, turns and parking restricted. Important streets were enlarged where possible, and attempts were made to remove or widen the more serious bottlenecks.

Much undoubtedly remains to be done in achieving the most effective use of existing street systems. Traffic experts, employing origin-destination surveys and other analytical tools, have achieved seeming wonders in some cities, often through such relatively inexpensive devices as synchronized and multiphase traffic lights and one-way streets. Parking bans, accompanied in the more enlightened instances by the provision of off-street parking facilities, have made available whole new traffic lanes, and indeed it would seem that the era of day-time curb parking in the downtown areas of large cities is rapidly drawing to a close.

Behind all such endeavours, however, lies the knowledge that cities grow, that traffic increases and that the amount of street space in downtown districts can usually be enlarged only at the expense of other valuable land uses.

> "Every outward extension of the urban area, every centrifugal expansion at the city's periphery, intensifies demand for transportation at the central core. As Holmes Perkins pointed out in his essay on the Regional City: 'The simple geometry of the plan will surely defeat us. The area available as we approach a centre shrinks as the square of the distance . . .'"[22]

In recent years, public imagination has been caught by the urban expressway; and indeed these enormously expensive constructions,[23] soaring over obstacles or swooping under them and throwing off spirals of slimmer progeny at raised intersections, are sometimes of considerable beauty. They are used in various ways—as by-passes, as ring roads or loops, and as so-called penetration arteries leading to city centres. A single expressway may combine two or more of these functions.

By itself, the expressway is far from being a solution to the urban traffic problem. It is simply another limited-access highway adapted to the urban environment—a means of moving many vehicles rapidly from A to B. Few of the vehicles, however, are likely to begin their journeys at A or end them precisely at B. At both extremities (and, of course, at intervening exits and

[22] *Forecast of Urban Growth Problems and Requirements 1956-1980,* a brief submitted to the Royal Commission by the Canadian Federation of Mayors and Municipalities, Montreal, 1956, Section G, p. G-18, "Urban Traffic and Transportation".

[23] The cost of urban expressways varies greatly according to terrain, the cost of land expropriation and the need for bridges, tunnels or elevated structures. In a flat suburban area, an expressway may perhaps be built for about $1 million a mile or even less; but in a heavily built-up downtown district, the cost may be many times this much. In Boston, a mile-and-a-half-long section of expressway through the central area of the city cost $40 million. A 750-foot section of the Northwest Expressway in Chicago, over a railroad yard, cost $7 million. (De Leuw, Charles E., "Problems of Expressways in Urban Areas", *Investment Dealer's Digest,* Section II, June 27, 1955.) Sometimes land expropriation can account for nearly half the total cost of an expressway.

entrances), local streets have to be used; parking places have to be found. If these additional requirements have not been properly looked after, the over-all traffic situation may, if anything, worsen. Instead of a multitude of jams,, there may be fewer and larger ones.

A disconcerting discovery has been made in connection with some expressways in the United States: they fill up to capacity on the day they are opened. It would seem that wherever traffic congestion has been acute, a large unsatisfied demand for personal automobile transport is likely to have accumulated. The inauguration of a spectacular new facility may call much of this forth, leading the traffic authorities to conclude that they are no further ahead.

Proponents of mass transit argue that no feasible combination of expressways, feeder routes and parking garages can ultimately solve the urban traffic problem. The object, they say, is to move people, not vehicles. This premise accepted, the logic of their case is impressive. The private car takes up from one-quarter to one-third as much street space as a transit bus but carries an average of less than two passengers, while the bus carries 30 or more.[24] It has been estimated that the carrying capacity per hour of a single lane of a city street is 1,280 persons in automobiles on surface streets, 2,560 in automobiles on limited-access roadways, 4,500 in buses on surface streets, 12,000 in street cars on surface streets, and 40,000 in underground trains.[25]

As for money comparisons, the average total cost of moving one passenger one mile in a certain Canadian city was calculated as three cents by bus and six cents by private automobile.[26] If only people who did not need their cars for their work would leave them at home and use public transportation, the traffic situation would be vastly improved and the total cost of movement reduced.

Expressway enthusiasts might reply, first that it is a free country and that the motorist cannot, in the words of one municipal official, be "derricked" out of his car;[27] and, second, that attempts to deprecate the private automobile as a costly and inefficient means of transport ignore its tremendous convenience value. Parking conditions permitting, it offers door-to-door service; it travels

[24]Canadian Federation of Mayors and Municipalities, *op. cit.*, p. G-9

[25]Canadian Transit Association's submission to the Royal Commission, Toronto, 1956, pp. 13-14.

[26]Canadian Federation of Mayors and Municipalities, *op. cit.*, p. G-10.

[27]. . . although he may, if worst comes to worst, be prohibited from driving his car on downtown streets. Some people think that such a ban may become inevitable in large cities;some, even, that it would be desirable.

It should be noted that there is a whole area of discussion of urban traffic problems which is excluded from the present report in accordance with the decision to restrict the subject matter to need and to eschew considerations of finance. There is thought in some circles that the physical dimensions of the over-all traffic problem, urban and rural, might be reduced by better pricing—i.e., by a more appropriate allocation of the cost of roads and streets between users and non-users. (See, for example, Brownlee, O. H. and Heller, Walter W., "Highway Development and Financing", *American Economic Review*, May 1956, pp. 232-250.) With reference to the urban traffic problem, the question is sometimes asked whether the urban motorist *as* a motorist is paying a fair share of the cost of his accommodation on city streets. If he is not, and if an appropriate adjustment were made, would the amount of private automobile traffic on the streets be significantly reduced? The question cannot be more than mentioned here: in order to deal with it properly, one would have to open up the whole field of road and street finance. In any case, this side of the matter receives very thorough treatment in *Taxes and Traffic* (Canadian Tax Foundation, *op. cit.*).

when and by what routes its driver chooses; it can bring the family breadwinner home from work and on the same journey pick up and deliver two sheets of plywood, a sack of potatoes, and a sewing machine.

Urban transit systems dependent on surface vehicles have, by and large, had a hard time of it since the Second World War.[28] Their volume of business has dropped off; their financial position has deteriorated. Neither equipment modernization nor the retention of low fares has served to reverse the decline. Ironically enough, the very private automobile which has taken the business away has also, by occupying the streets in greater numbers, made transit service slower and less dependable, and so less attractive to the public.

> "Up to now most civic efforts to improve traffic conditions invite more motor vehicles to use the streets and augment transit's competition and its difficulties in meeting it. This means delayed service, disorganization of schedules and a more costly operation. This, in turn, breeds dissatisfaction among its passengers and a consequent loss of some of their vital patronage. So, in a desperate effort to make ends meet, management cuts service or raises fares, again with a resulting loss of passengers and revenue."[29]

Some informed observers are becoming convinced that what transit must offer, if it is to regain lost business and contribute to the improvement of traffic conditions, is above all speed.[30] The success of the Toronto subway, and the fact that rapid transit volume in the United States has held up better than transit volume in general, are regarded as significant. When transit can provide faster transportation than any motorist can hope to match, people may indeed start to leave their cars at home.[31]

Clearly, this cannot be achieved on ordinary streets. It is in the nature of the transit vehicle, picking up and letting off passengers, that in any direct contest with the private automobile on the same crowded strip of asphalt, it will always emerge the loser. But given a right-of-way of its own, with no interference from other traffic, it can usually show itself superior notwithstanding stops.

The subway, the commuter railway line, and the less familiar elevated monorail are good examples of the exclusive right-of-way; but they are not the only ones. Facilities such as these, of great capacity and high initial cost, cannot usually be contemplated in small or medium-sized cities, or even in the more thinly populated reaches of large metropolitan areas. There are other means, however, by which transit vehicles can, so to speak, be given

[28] See Due, John F., "The Third 'T': Transit", *Canadian Tax Journal*, May-June 1956.

[29] Canadian Transit Association, *op. cit.*, p. 7.

[30] Due, John F., *op. cit.*, p. 179.

[31] ". . . or in parking lots at the suburban extremities of transit routes. Apparently, however, experience with this kind of facility has so far not been too encouraging. (See Wilbur Smith and Associates, *Traffic and Transportation Plan for Ottawa, Canada*, 1954, p. 140.)

their head. Transit strips can be provided in conjunction with expressways; or certain streets can be reserved for the exclusive use of buses, with cross-traffic either eliminated by grade separations or regulated by suitably timed traffic-lights.[32]

Regardless of what can be accomplished in facilitating movement to and from city centres, the character of those centres will almost certainly have to change. Their day-time population density may have to be restricted. Establishments which do not really need to be downtown may have to be encouraged to locate elsewhere.

Possibly, in order to survive as a major focus of urban life, "downtown" will have to take a leaf from the neighbourhood shopping centre and insulate vehicle from pedestrian movement. A scheme has been set on foot in Fort Worth, Tex., to have all roads leading downtown end in a loop around the central core.[33] Just within the loop would be a number of strategically located parking lots or garages; from there on, the pedestrian would be supreme. All major activities would be within two or three minutes' walking distance of one or other of the parking facilities. Vehicular pick-ups and deliveries would presumably be made through underground tunnels, as in some shopping centres today.

> "The important thing is the acceptance of the basic concept: that the automobile and the truck, the street car and the bus have no place in the heart of our cities; that their function should be limited to bringing people *to* the central business district; and that the streets and the plazas and the parks should be given back to the people."[34]

Future down town areas might conceivably consist of clusters of such islands—of archipelagos.

In the final analysis, the traffic problem cannot be considered in isolation. Traffic, after all, is but an aspect of the life and workings of a city: it impinges on other activities and is impinged on by them. Aggrieved car-owners may feel that the traffic situation requires special attention, perhaps a special authority; but it is inviting frustration to suppose that traffic measures can be considered apart from the rest of urban planning, for what is done about traffic affects nearly everything else, and what is done about everything else just as surely affects traffic. A new subdivision, to take a simple example, is, among other things, a traffic generator, and its size, location and layout will all have their influence on the over-all pattern of movement. The larger the urban area involved, the sooner the study of traffic problems is likely to confront the investigator with some of the most fundamental questions of urban planning. What kind of cities do we want? To what extent is private auto-

[32]An arrangement somewhat of this sort has been proposed for Ottawa: when street cars are taken off the present Britannia line, the right-of-way will be paved and reserved for buses.

[33]Van Leuven, Carl, "Integrating Architecture and the Arts", *Journal of the Royal Architectural Institute of Canada*, June 1956, pp. 226-227.

[34]*Ibid.*, p. 226.

mobile usage an immutable fact of life to which the city must adapt? To what extent can automobile usage be adapted to the city?

Great opportunities exist, as cities expand outward, to avoid some of the mistakes of the past. The street pattern of a new suburb is likely to remain fixed for a good many years, long after the neighbouring cows and poultry have departed and the district has come to be regarded as relatively "close in". Under the circumstances, it would seem essential to develop layouts which would avoid the peculiar disadvantages of the grid system, and which would give some assurance of being able to cope with future demands as well as present ones. Many new subdivisions are now laid out in what is sometimes called a spaghetti pattern. Boundary streets are built as through-ways with relatively limited access; other streets are designed to discourage through driving yet remain adequate for local purposes. Shopping centres, schools, and other community facilities are located more or less centrally within the development, so that it is possible to reach them without crossing main arteries. Significant cost savings may be effected through the reduction of cross streets: in one such subdivision in Edmonton, internal street mileage was reduced by more than 27%.[35]

The importance of good street planning on the outer fringe is increased where industry is moving to the suburbs on a large scale. Heavy new traffic flows arise, complicating the older pattern of a single downtown-suburban rush.

Urban Traffic: Conclusions

The sum of the above considerations does not, unfortunately, constitute a clear guide for expenditure forecasting. It seems evident that a great deal of money will have to be spent on keeping abreast of the urban traffic problem, but just how it will be spent is quite impossible to say. There is no one agreed solution; a period of further experimentation appears to lie ahead. Some cities may put the emphasis on expressways and parking garages, others on transit. Perhaps, in the long run, a thorough redesigning of downtown areas, integrated with street and transit improvements and with the planning of suburban growth, may prove to be the answer. One might hazard the guess that western cities, with their broader streets and more extensive mode of living, may be more inclined, initially at least, to emphasize expressways, whereas central and eastern cities may have to give more and earlier attention to other lines of attack.

Prospective Growth of Traffic

What over-all increase in motor vehicle traffic may be expected to occur in Canada during the next 25 years? Ideally, the answer to this question should involve consideration of prospective economic and urban growth,

[35] . . . from about 7.2 miles to 5.2 miles. The mileage of utility and service lanes was reduced from 5.2 miles to 4.4 miles. (See Beecroft, Eric, "Let Us Make Our Cities Efficient", *Commercial Letter*, Canadian Bank of Commerce, October 1955, pp. 4 and 5.)

trends in the development and improvement of alternative means of transport, probable improvements in the road system, etc. There are many fascinating avenues of inquiry: Will the private automobile have the same prestige value in 1980 as it has today? What are the prospects for the helicopter? What might happen in the field of rapid transit if the cost of centrally generated electricity went down in relation to the cost of gasoline or of whatever fuel automobiles are using 10 or 20 years from now?

Some of the possibilities seem easier to assess than others. A number of the more tangible factors are taken into account in the forecast of motor vehicle registrations which appears in the study on the automotive industry prepared for the Royal Commission. The basic assumption with respect to population is the same as for the present report. Further assumptions are made regarding such things as disposable income, consumer tastes and scrappage rates.

According to the forecast, the Canadian motor vehicle "population" would seem destined to reach a figure more than three times the 1954 total. Between 1954 and 1980, the number of passenger cars would increase by 226%, that of commercial vehicles by 155%.[36]

Table 37

FORECAST OF VEHICLE REGISTRATIONS IN CANADA

(thousands of vehicles)

	Passenger cars	Commercial vehicles	Total[a]	Commercial vehicles as percentage of total
1954	2,688	919	3,607	25.5%
1965	4,725	1,315	6,040	21.8%
1970	5,900	1,605	7,505	21.4%
1975	7,250	1,945	9,195	21.2%
1980	8,750	2,340	11,090	21.1%

a Excludes motorcycles.

SOURCE: *The Canadian Automotive Industry*, a study prepared for the Royal Commission, pp. 84, 92.

If the figures seem high, one may perhaps put them into perspective by saying that, in terms of the population forecast on which they are based, they would imply the attainment by 1980 of a persons-to-motor-vehicles ratio of about 2.4. Vehicles are already denser than this in the state of California[37] and in the cities of Victoria, B.C., and Toronto.[38]

[36]The forecast of commercial vehicle registrations is made on a somewhat different basis from the forecast of passenger car registrations. The statement is made that "the impact of future trends in prices, taxes, operating costs and traffic congestion on sales of trucks is expected to be less favourable than for passenger cars". No attempt is made to project truck sales by classes or sizes of vehicles; however it is thought that urban-service vehicles and heavy vehicles may show relative gains at the expense of medium-weight vehicles. (See *The Canadian Automotive Industry*, pp. 91-94.) The view is expressed in "Urban Traffic and Transportation", Canadian Federation of Mayors and Municipalities, p. G-16, that vehicles 25 years hence will be heavier in average weight, thanks to substantially increased numbers of heavy trucks and tractor-trailers catering to decentralized industrial and commercial establishments.

[37]Canadian Federation of Mayors and Municipalities, *op. cit.*, p. G-13.

[38]Canadian Tax Foundation, *op. cit.*, p. 88. Estimating population/vehicle densities in cities is a tricky business, and the results should be treated with reserve. It is calculated that in 1952, there were 1.3 persons per vehicle in Victoria and 2.2 persons per vehicle in Toronto. Since then, other cities may have passed the 2.4 mark. It is thought that the ultimate saturation point of vehicle density—the point at which the ratio would be stabilized—might be about 1.75 persons per vehicle in urban and rural areas combined and 1.5 persons per vehicle in urban areas. (Canadian Federation of Mayors and Municipalities, *op. cit.*, pp. G-14, G-15.)

Even if the average vehicle were used no more in 1980 than it is today, there would thus be a tripling of traffic. It may be, however, that vehicle usage will increase. A projection for Ontario would indicate a rise in average travel per vehicle per year from 8,610 miles in 1954 to 9,500 miles in 1975 and 1980; and since in recent years gasoline consumption per vehicle in Ontario has been close to the national average, it may be permissible to apply this projection to the vehicle forecast for the whole of Canada, as is done in Table 38.

Table 38

FORECAST OF MOTOR VEHICLE TRAVEL IN CANADA

	Forecast of vehicle registrations (thousands of vehicles)	Forecast of average annual travel per vehicle (miles)	Forecast of total annual travel (millions of vehicle-miles)
1954.....	3,607	8,610[a]	31,056
1965.....	6,040	9,300	56,172
1970.....	7,505	9,400	70,547
1975.....	9,195	9,500	87,353
1980.....	11,090	9,500	105,355

a Ontario estimate.

SOURCES: Vehicle registrations—as for previous table.
Vehicle travel—*Prediction of Traffic in Ontario,* Planning and Design Branch, Department of Highways, Province of Ontario.

Total vehicle travel might then increase by about three-and-a-third times. Given a greater degree of urbanization, such as is being assumed, one might expect urban traffic to show an even larger proportionate increase than traffic in general. The total urban movement would inevitably be spread over a wider area; even so, the prospect is awesome enough.

The relationship between traffic growth and the state of the road system is, of course, of a two-way character: increases in traffic create a need for road expenditure; but traffic growth in turn is influenced by the adequacy or inadequacy of roads and streets. To the extent that over-all traffic conditions grow worse, both the sales and the use of motor vehicles will be adversely affected.[39]

Highway Programmes in the United States

It is appropriate to refer briefly to the estimates of highway need in the United States which appear in the Clay Report[40] and to the stepped-up federal-aid highway programme now under way in that country.

[39]So far as passenger cars are concerned, it is believed that the state of the road system has more effect on the average mileage driven each year than on the number of cars sold. (*The Canadian Automotive Industry,* op. cit., pp. 90-91.)

[40]The President's Advisory Committee on a National Highway Program, *op. cit.*

In 1954, the Secretary of Commerce was directed to make a comprehensive study of all phases of highway financing, including a study of the costs of completing the several systems of highways. The work was actually carried out by the Bureau of Public Roads, a federal agency, in co-operation with state highway departments and local units of government. Estimates of need were developed on the basis that the interstate system of highways should in ten years be extended and improved until it was adequate for the traffic of 1974, while, with respect to other systems, provision should be made for the replacement or reconstruction of portions which were already inadequate or likely to become so by 1965.

The estimates obtained doubtless varied in quality from state to state depending on the amount of prior study carried out. The final result, however, was a far more authoritative estimate of national highway need than could possibly be made in Canada in the present state of information; and for that reason alone the figures are deserving of attention here.

It was estimated that vehicle registration in the United States would increase by 40%—from 58 million in 1954 to 81 million in 1965. Total travel would rise by 46%—from 557 billion vehicle-miles to 814 billion vehicle-miles annually.[41] Canadian figures for the same period, as given in the preceding section, would indicate rises of 67% and 81% in registrations and travel respectively. The comparison does not necessarily throw doubt on the Canadian forecast: vehicles are denser in the United States than in Canada,[42] and experience has shown that reductions in the ratio of persons to motor vehicles tend to occur at a diminishing rate as the theoretical saturation point is approached.[43] The number of vehicles has increased relatively more in Canada than in the United States since the Second World War,[44] and it is expected that there will be some further catching up.[45]

Table 39 shows the 10-year construction programme recommended by the Clay Committee:

Table 39

10-YEAR NATIONAL HIGHWAY PROGRAM (U.S.)

(billions of U.S. dollars)

System	Rural	Urban	Total	Annual Average
Interstate: existing	12	11	23	2.3
extended	—	4	4	0.4
Federal-aid primary	20	10	30	3.0
Federal-aid secondary	15	—	15	1.5
Sub-total, federal-aid systems	47	25	72	7.2
Other roads and streets	17	12	29	2.9
Total, all systems	64	37	101	10.1

SOURCE: *A 10-Year National Highway Program*, the President's Advisory Committee on a National Highway Program, Washington, 1955, p. 12.

[41] *Ibid.*, pp. 5, 7.

[42] Persons per motor vehicle in 1954: U.S., 2.8; Canada, 4.2

[43] Canadian Federation of Mayors and Municipalities, *op. cit.*, pp. G-13, G-14.

[44] Between 1946 and 1954, motor vehicle registrations increased 73% in the United States and 125% in Canada.

[45] Canadian Federation of Mayors and Municipalities, *op. cit.*, p. G-13.

The committee estimated that, under programmes actually in effect at the time of its report and with allowance for growth in vehicle registration and usage, some $47 billion might be made available for construction over the 10-year period.[46] In calling for a total programme of $101 billion, the committee was thus recommending slightly more than a doubling of expenditure on roads and streets. (Actual construction expenditure in 1954, it may be noted, was $3.9 billion.[47])

A further point of interest is that nearly 37% of total expenditure under the programme would have been in urban areas, compared with 27% actually expended in such areas in 1954.

The programme ultimately approved by Congress and now in course of implementation is of a more modest size but still impressive. The ten years have been stretched to 13. One cannot say for certain just what will be spent over this period: many of the necessary federal appropriations have still to be made, and much will depend on the extent to which the states fulfil their matching requirements. However, expenditure of perhaps $50 billion on federal-aid roads and streets would seem to be in prospect.[48] If expenditure on non-federal-aid roads and streets were to be continued at the 1954 level,[49] total expenditure might then amount to about $90 billion, or an annual average of $6.9 billion. Again, this may be compared with actual expenditure of $3.9 billion in 1954.

Three Forecasts of Construction Expenditure

Enough has been said to indicate that at the present time any forecast of road and street expenditure in Canada cannot be far removed from pure guesswork. In the three forecasts which follow, an attempt is made to employ the available data to the best advantage.

A number of provincial and municipal governments and agencies thereof incorporated forecasts of road and street expenditure in briefs to the Royal Commission. Additional forecast material was obtained through correspondence and interviews with various government officials. Estimates of this kind are particularly valuable in that they can be presumed to reflect an experience of local conditions which an outsider could not possibly possess. Topography alone makes for a great variation in the character of road needs, and in the severity of roadbuilding problems, from one part of Canada to another. The cost of the Trans-Canada Highway can vary from perhaps $70,000 or $80,000 a mile on flat prairie to $500,000 a mile in heavy mountainous country in British Columbia.[50] Similarly, differences in the

[46]The President's Advisory Committee on a National Highway Program. *op. cit.*, p. 16.

[47]*Highway Statistics 1954* (annual), Bureau of Public Roads, U.S. Department of Commerce, Washington. The figure excludes some relatively small expenditures on federal forest roads, etc.

[48]"Who Will Get the 50 Billions for Roads", *U.S. News and World Report*, June 29, 1956, p. 27.

[49]$2.8 billion. (*Highway Statistics 1954*, Bureau of Public Roads, U.S. Department of Commerce.)

[50]"Representative" costs. Particular sections in British Columbia have cost as much as $1 million a mile.

topography and situation of cities are of great significance with respect to arterial roads in particular. The combination of sea, mountains, and delta in the Vancouver area; the proximity of Windsor to Detroit; the island situation of Montreal—each poses peculiar problems.[51]

Unfortunately, the governmental forecasts are by no means complete in their coverage. Some provinces did not make forecasts; others limited their estimates to certain portions of their road systems. Still others looked ahead 10 or 20 years instead of 25. Rather than make no use of the material, it was decided to fill in the larger gaps by means of various kinds of estimation, with results as shown a little further on.

The amount of gap-filling that was necessary is indicated in Table 41. In three provinces—Quebec, Ontario and British Columbia—available forecasts of construction expenditure on highways and rural roads covered periods of ten, ten, and 20 years respectively. The forecasts were extended to 25 years on the assumption that expenditure would rise proportionately with the expected rise in the vehicle population for the whole of Canada.

Few cities submitted complete forecasts of expenditure on urban streets. It was therefore decided to make an entirely separate estimate of new *local* street requirements, based on the housing forecast of Chapter 3.[52] With respect to *arterial* streets, the cities of Montreal, Ottawa and Winnipeg, the Municipality of Metropolitan Toronto, and the Technical Committee for Metropolitan Highway Planning (Vancouver) provided relatively comprehensive forecasts of arterial street expenditure over all or most of the 25-year period. The assumption was made that arterial street expenditure in other metropolitan and major urban areas would be the same amount, reduced by the proportion which the total 1951 population of these areas bore to the total population of the places named.

With respect to federal government expenditure, the basis of estimate was a forecast by the Minister of Public Works that average annual expenditure on highways by the federal government during the period 1956-60 inclusive would amount to about $55 million.[53] It was assumed that, notwithstanding the completion of the Trans-Canada Highway, this rate would be maintained until 1980, giving a 25-year total of $1,375 million. From this

[51]Climate, soil conditions, the presence or absence of rock, and the distance over which gravel and other materials must be hauled should also be mentioned as important variables bearing on road and street costs. In the brief of the Province of Alberta, p. 296, it is shown how the cost of a certain type of paved highway with a 50-foot subgrade can vary from $99,700 a mile in a dry prairie district close to sources of supply to $141,150 in a muskeg region where gravel and asphalt must be brought in by train.

[52]See Appendix VII.

[53]Federal-Provincial Highway Conference, November 14, 1955. Of the $55 million, $35 million would represent payments to provinces in respect of the Trans-Canada Highway, $10 million expenditure on the Trans-Canada Highway in national parks, and $10 million expenditure on highways other than the Trans-Canada Highway in national parks and in the Yukon and Northwest Territories. Some of the latter amount would presumably be for maintenance.

A separate estimate of the cost of development roads which may be built in the Yukon and Northwest Territories has been prepared by the Department of Northern Affairs and Natural Resources. The total cost of roads "likely to be required" within 25 years is given as $31 million. The cost of "other roads which may possibly become necessary if resource developments take place in these regions" is given as $56 million.

Table 40

ROAD AND STREET CONSTRUCTION EXPENDITURE[a]

Forecast A

(based on provincial and municipal forecasts, supplemented by other estimates)

	Construction expenditure (millions of 1955 dollars)		Actual construction expenditure in 1954 (millions of 1954 $)
	Period 1956-80	Annual average, 1956-80	
1. By type of road			
Highways and rural roads	14,846	594	229
Major urban arteries	2,100[b]	84	50
Other urban streets	2,870	115	
Total	19,816	793	279
2. By province			
Newfoundland	241	10	8
Prince Edward Island	144	6	3
Nova Scotia	908	36	7
New Brunswick	601	24	8
Quebec	4,174	167	69
Ontario	7,005	280	72
Manitoba	870	35	14
Saskatchewan	1,013	41	15
Alberta	1,594	64	52
British Columbia	2,109	84	28
Yukon and Northwest Territories and federal expenditure not allocated by province	1,157	46	2[c]
Total	19,816	793	279

a Includes expenditure on related bridges, culverts, ferries, sidewalks, etc.

b It is of interest to compare with this figure the amount which may be invested in urban transit services over the same period. Members of the Canadian Transit Association have forecast their capital expenditure from 1956 to 1980 inclusive at $647.3 million.

c Not comparable with annual average figure.

was then deducted some $218 million in federal expenditure identified in provincial forecasts.

Persons interested in interprovincial comparisons will, it is hoped, bear in mind the heterogeneous and tenuous nature of the over-all forecast. Figures for some provinces represent largely the opinions of competent authorities in those provinces; figures for other provinces do not. Some provinces attempted to forecast minimum programmes only: in the Newfoundland brief, for example, the amount shown for highways is characterized as "grossly inadequate".[54]

Nor should the urban-rural breakdown be taken too seriously. Not only are there some overlappings of provincial and municipal estimates (although

[54] Submission of the Province of Newfoundland, p. 130.

these were eliminated where possible), but there is a strong presumption that the indicated urban share in total expenditure may be too low. The forecast of urban growth may once again be recalled, together with the recommendation of the Clay Committee that nearly 37% of their proposed expenditure programme be carried out in urban areas. It has been estimated that 50% of all motor vehicle movement in Canada occurs in urban areas;[55] yet expenditure on urban streets in 1954 accounted for only 18% of total road and street construction expenditure. The forecast would indicate a rise to 25% of the total, but some further relative gain should probably be expected.[56]

Table 41

DERIVATION OF FORECAST A

(millions of 1955 dollars)

From provincial and municipal briefs	5,757
From other official sources	2,444
From unofficial sources	754
Sub-total	8,955
Extensions, based on estimated growth in vehicle registrations of provincial forecasts	6,038
Estimate of local urban street requirements, based on housing forecast	2,870
Other estimates	1,953
Grand total	19,816

A second forecast is based on actual construction expenditure since the Second World War and on the forecast rise in vehicle travel. Over the period 1946-54, construction expenditure per motor vehicle registered, expressed in 1949 dollars, would appear to have averaged $73 annually.[57] This is boosted to $80 to allow for the estimated 10% shortfall in statistical coverage. The $80 is then multiplied by forecast vehicle registrations for the years 1965, 1970, 1975, and 1980, and the results are multiplied again by adjustment factors designed to allow for increased travel per vehicle.

By this method, a forecast of total construction expenditure amounting to $15.3 billion in 1949 prices is obtained. Conversion to 1955 prices yields a figure of $21.2 billion.

The shortcomings of the method are obvious. Perhaps the chief objection to it is that there is simply no knowing whether $80 per vehicle, adjusted for increased travel, represents an adequate level of expenditure for the future.

[55]Statement by C. W. Gilchrist, Managing Director, the Canadian Good Roads Association, as reported in the *Globe and Mail*, Toronto, August 22, 1956, p. 5: "Traffic Light Criticized as Accident Invitation".

[56]It will be observed that the forecast of arterial street requirements makes no provision for places other than metropolitan areas and "other major urban areas". Many such places will doubtless have to undertake important arterial projects as their populations grow. There is, too, a category of urban street expenditure—on secondary arteries, street widenings etc.—which the local and arterial street forecasts do not adequately cover.

[57]Using implicit price deflator unadjusted. See Table 36.

Having regard to the large backlog which almost certainly exists, one would suspect that the figure might be on the low side.

Theoretically at least, the third forecast, based on a "needs factor", should be superior in some respects to the second. Needs factors are a by-product of highway needs studies or, more precisely, of recommended expenditure programmes drawn up on the basis of such studies. These programmes normally include *all* road costs—new construction and reconstruction, betterments, maintenance and administration. The total of such costs for, say, a 20-year programme may then be divided by an estimate of the total vehicle-miles of travel that will occur over the period. The result—the average cost per vehicle-mile travelled—is the needs factor for that programme. Usually, such programmes provide for a gradual catching up with traffic growth over the entire period, rather than for an abrupt making good of existing backlog followed by a shallower rise in expenditure thereafter. Given a year-by-year forecast of vehicle travel, the needs factor should thus provide some guide to the appropriate level of expenditure at any stage of the programme.

Table 42

ROAD AND STREET CONSTRUCTION EXPENDITURE[a]

Forecast B

(based on vehicle registrations and average travel per vehicle)

1. In 1949 Prices

Years	(1) Forecast of vehicle registrations (thousands of vehicles)	(2) Construction expenditure at $80 per vehicle per year (millions of dollars)	(3) Adjustment factor to allow for increased travel per vehicle[b]	(4) Construction expenditure adjusted (millions of dollars)
1965	6,040	483	1.08	522
1970	7,505	600	1.09	654
1975	9,195	736	1.10	810
1980	11,090	887	1.10	976
Periods				
1956-65	—	4,070	—	4,270
1966-70	—	2,708	—	2,940
1971-75	—	3,340	—	3,660
1976-80	—	4,058	—	4,465
1956-80	—	14,176	—	15,335
2. In 1955 Prices		($110 per vehicle per year)		
Periods				
1956-65	—	5,617	—	5,893
1966-70	—	3,737	—	4,057
1971-75	—	4,609	—	5,051
1976-80	—	5,600	—	6,162
1956-80	—	19,563	—	21,163

a Includes expenditures on related bridges, culverts, ferries, sidewalks, etc.

b Projected travel per vehicle in Ontario for years shown, divided by estimated average annual travel per vehicle in Ontario over the period 1946-54 inclusive.

Needs factors have been calculated for several states in the United States, as shown in Table 43.

The advantage of using a needs factor approach to Canadian road forecasting—again in theory—is that the programmes from which needs factors are derived normally make provision not only for backlog, but for the replacement of roads which are likely to become worn out physically during the period. Allowance is made also for building roads strong enough to withstand use by increasing numbers of heavy commercial vehicles.

Table 43

TOTAL COSTS OF 20-YEAR ROAD PROGRAMMES IN CENTS PER VEHICLE MILE

	Trunklines		Feeder systems	Local roads	Total
	Urban	Rural			
West Virginia	.88	1.35	2.20	4.52	1.40
Ohio	.60	.86	1.48	1.92	.90
Mississippi	.48	.60	2.30	3.90	1.08
Kansas	.67	1.34	2.50	4.50	1.60
North Dakota	1.08	1.42	2.13	2.22	1.50
Minnesota (15 years)	1.01	.75	1.95	3.00	1.17

SOURCE: Automotive Safety Foundation, *Highway Needs in West Virginia*, p. 61.

Table 44

ROAD AND STREET CONSTRUCTION EXPENDITURE[a]

Forecast C

(based on total vehicle travel and "needs factor")

(1955 prices)

Years	(1) Forecast of total annual travel (millions of vehicle-miles)	(2) Total road expenditure at 1.5 cents per vehicle-mile (millions of dollars)	(3) Road construction expenditure at 75% of total expenditure (millions of dollars)
1965	56,172	843	632
1970	70,547	1,058	794
1975	87,353	1,310	983
1980	105,355	1,580	1,185
Periods			
1956-65	—	6,890	5,168
1966-70	—	4,753	3,565
1971-75	—	5,920	4,440
1976-80	—	7,225	5,419
1956-80	—	24,788	18,591
Add: local urban street expenditure as per Forecast "A"		—	2,870
Grand total, 1956-80 incl.		—	21,461

a Includes expenditure on related bridges, culverts, ferries, sidewalks, etc.

When preliminary calculations were being made for the Ontario highway study, a needs factor of 1.5 cents per vehicle mile was tentatively selected as an appropriate one for that province. Completion of the study may yield a different value;[58] however, 1.5 cents is the figure used for the whole of Canada in Table 44. Construction is calculated at 75% of total expenditure, this being roughly the proportion recommended in three recent programmes, based on needs studies, in the United States.[59] Since the 1.5 factor makes no allowance for local urban streets, the relevant figure from Forecast A is added in, giving a grand total of 21.5 billion.

Land Cost

Unlike the actual building of roads, the acquisition of land for road-building purposes does nothing to increase a country's gross capital stock or to replace old assets with new ones. It is a mere transfer of ownership. A forecast of capital investment in roads and streets should therefore exclude the cost of acquiring right-of-way.

The point has been made that land cost may in future be a relatively more important element in the total cost of new highways and rural roads. The same can be said about urban streets in areas where major expressways are being built.

In the United States, the cost of right-of-way as a percentage of the total cost of new roads is said to vary from 8% for rural roads outside the federal-aid systems to 16% for one kind of multilane rural highway, and from 25% for ordinary city streets to 35% for a six-lane urban expressway.[60] These are not maxima and minima, but merely representative percentages for certain categories of roads and streets. They cover cases where complete new rights-of-way have to be acquired.

At present, of course, much road and street construction in Canada takes place on existing rights-of-way, and this will doubtless be true in the future, though to a lesser degree. In one of the Prairie Provinces, expenditure on land acquisition as a percentage of the total construction cost of rural highways has in recent years been in a range of only 0.7% to 1.4%. A survey of provincial public accounts and departmental reports for the fiscal year 1954-55 shows an *identifiable* expenditure of $8.8 million on land acquisition for highways. It is likely that more than this was actually spent; the figure, however, may be compared with the 1954 estimate of total construction expenditure on highways and rural roads: $229 million.[61]

[58] In *A Plan for Ontario Highways* (Ontario Department of Highways, 1957), which appeared shortly before the present report went to press, a 20-year programme is outlined, covering rural Queen's Highways and other roads for which the Department of Highways is directly responsible. The needs factor for this programme is given as about 0.9 cents per vehicle mile. It is likely, however, that when needs studies are extended to roads which are not the direct responsibility of the province, the needs factor for the entire road system will prove to be higher than the figure quoted. As Table 43 suggests, needs factors for feeder and local roads are likely to be considerably higher than those for major trunklines.

[59] In the states of West Virginia, Michigan and Kentucky

[60] "What Kind of Roads Must We Build?" *Engineering News-Record*, Dec. 30, 1954, p. 42

[61] *Highway Statistics* (annual), Dominion Bureau of Statistics.

Most of the provincial and municipal estimates utilized in Forecast A include some allowance for land cost. The Dominion Bureau of Statistics figures which form the basis for Forecast B include only such land cost as is incurred in the same year as the corresponding construction cost; but in practice, land is often acquired well in advance of actual construction. Forecast C includes all land cost.

Since the cost of land for new local urban streets is usually borne, initially at least, by subdividers, it does not as a rule enter into calculations of total street costs. Allowance is certainly made, however, for the cost of land for urban arterial roads. Possibly as much as 30% of the figure for urban arterial roads in Forecast A—i.e., $630 million—should be deemed to represent land cost.

A land-cost allowance for all roads and streets can only be of the most arbitrary character; however, perhaps 9% of the total cost of new construction including land would be a reasonable proportion.

Final Forecast

The figure of $21.3 billion given in Table 45 for construction expenditure on roads and streets, inclusive of land cost, is a compromise among Forecasts A, B and C. Forecast B is boosted by 7% to allow for the prior-year land cost that has just been referred to; then an average of the three

Table 45

ROAD AND STREET CONSTRUCTION EXPENDITURE[a]
Composite Forecast
(millions of 1955 dollars)

	Including land cost	Excluding land cost
1. By Periods		
1956-65 incl.	5,921	5,419
1966-70 incl.	4,090	3,743
1971-75 incl.	5,091	4,660
1976-80 incl.	6,198	5,673
Total, 1956-80 incl.	21,300	19,495
2. By Provinces		
Atlantic	2,279	2,075
Quebec	4,430	4,031
Ontario	7,434	6,765
Prairies	3,685	3,353
British Columbia	2,237	2,036
Yukon and Northwest Territories and federal expenditure not allocated by province	1,235	1,235
Total, 1956-80 incl.	21,300	19,495

a Includes expenditure on related bridges, culverts, ferries, sidewalks etc.

is calculated. The allocation by sub-periods is based on the forecast of travel, while the relative distribution by provinces is the same as in Forecast A, except that Newfoundland's share has been doubled. It is assumed that land cost in the Yukon and Northwest Territories, and in respect of federal highway expenditure not allocated by provinces, will be negligible.[62] Otherwise, land cost is calculated at a uniform 9% of total cost, even though it is likely that there will be considerable interprovincial variation, arising from greater or lesser degrees of urbanization and other differences.

It should be noted that the sub-period allocation is not adjusted for backlog, mainly because there is no reliable indication of what the existing backlog is. If a programme were undertaken to make roads and streets fully adequate by, say, 1965, then expenditure from 1956 to 1965 inclusive would account for a larger share of the total.

A comparison with United States figures may serve as a very rough check. The Clay Committee recommended that the United States spend $101 billion on road and street construction over ten years. According to the forecast above, Canada would spend $5.9 billion, or about one-seventeenth as much, over the period 1956-65 inclusive. On a simple comparison of 1955 populations,[63] one might think that the Canadian figure looked low. It should be recalled, however, that the Clay Committee was proposing that the interstate system of highways should be made adequate not for ten, but for 20 years, and that other federal-aid systems should be brought up to the demands of 1965. In other words, by 1965 there would be no backlog so far as the federal-aid systems as a group were concerned; indeed, there would be capacity in hand for the future.

[62]The federal government does not contribute to the cost of obtaining right-of-way for the Trans-Canada Highway.

[63]Estimated populations, June 1955: Canada, 15.6 million; U.S. (continental), 165 million.

7

WATERWORKS

PURE, FRESH WATER is a necessity of life and, in general, Canada is a well-watered land. Our country has within and along its borders innumerable lakes, several of which are among the largest bodies of fresh water in the world. It has mighty rivers flowing into three oceans, countless smaller rivers and streams and a rainfall adequate to meet a high demand for water. Thus we have been blessed with a vast supply of this great natural resource, which, if it is properly protected, should be adequate to serve a population several times the present one. At the same time it should be recognized that there are, even now, localities where the problem of an adequate water supply is of grave concern.

In our modern and increasingly urban and industrial civilization water, as delivered to the consumer is, in effect, a manufactured product. A waterworks system consists of supply works, involving either underground or surface waters, the purification works or whatever works are required to produce a safe and suitable supply, the distribution system of feeder mains and laterals, and the storage works, either at the source of supply or in the distribution system or in both locations. The design must meet not only present needs but those of the early future. The sources of supply must be protected.

In addition, water services must be geared to serve a variety of needs. First comes domestic consumption; next fire protection, which necessitates larger mains, greater storage capacities and high pumping rates, even though these may be needed for only a small portion of the time. Industrial demands in an area may be large and increasing. Furthermore, water is used for lawn-sprinkling, recreation, air-conditioning and the like. At present about nine and a half million persons[1] in Canada obtain their drinking water through public water-supply systems, and it is estimated that by 1980 the population so served will exceed 21 million. This estimate makes allowance for the expected increase in urban population from 1955 to 1980, for the extension

[1] *The Municipal Utilities Magazine*, 1956 annual directory number.

of water service to some communities too small to be classified as urban and for the servicing of some parts of existing urban areas which are at present without public water supply.

Water consumption now is about 100 gallons daily per capita, but the rate over the day or the month will vary considerably, and consumption has tended to rise over recent years. Studies in the United States show that the per capita water consumption from municipal systems rose during the 1940-53 period from an average of 108 to 119 gallons a day. Comparable figures no doubt apply in Canada. In Brantford, Ont., for example, per capita water consumption rose from 96 gallons a day in 1946 to 146 gallons in 1956. In Toronto it rose from 127 gallons a day in 1946 to 146 gallons in 1956, and in Peterborough, Ont., from 100 gallons a day in 1946 to 135 gallons in 1956. In Ottawa per capita consumption has decreased in recent years. Universal metering and constant checking in the distribution system for underground leaks have been credited with cutting down wastage.

Today's daily demand for water from public systems in Canada is estimated at slightly less than one billion gallons. On the assumption that our population will increase from 15.6 million in 1955 to 26.7 million persons in 1980, the daily consumption at that time might reach two and a half billion gallons. It is estimated that $2.4 billion will be needed for capital expenditure on public waterworks systems to meet this demand.

Table 46

ESTIMATED CAPITAL REQUIREMENTS FOR WATERWORKS, 1955-80

(1)	(2)	(3) Estimated capital requirements	(4)
Province or region	Estimated increase in persons served (thousands)	In millions of 1955 dollars	In dollars per capita, based on col. 2
British Columbia	1,252	175	$140
Alberta	811	125	154
Saskatchewan	416	62	149
Manitoba	466	100[a]	215[b]
Ontario	4,690	780	166
For feeder pipelines pumping installations, irrigation feed lines, etc.		400	85
Quebec	3,778	675	179
Atlantic	669	90	135
Total ex. feeder lines	12,082	2,007	166
Feeder lines		400	
Grand total		2,407	

a Includes an expenditure of $36 million expected to be made in Greater Winnipeg in the period 1975-80.
b See footnote a.

Of the many factors considered in calculating this estimate, a principal one was the expected increase in the number of persons to be served. Others of importance were: the proximity and adequacy of sources of supply; whether, particularly in large urban centres, existing facilities were considerably in excess of those needed to serve the present population or whether they were just adequate; likely industrial demands; the number of smaller urban centres which require water services but do not now have them; and replacement requirements to maintain existing systems in good condition. These and other factors studied are described in more detail in the regional notes which follow. Table 46 shows by province or region the the estimated increase in the number of persons to be served in the period and the estimated capital requirements needed to provide the services. It was assumed that the needs of many of the smaller urban places now without services would be met.

Regional Notes

The following notes have been gleaned from briefs presented to the Royal Commission and from a variety of other sources. Figures showing the number of water systems and the population served have been taken from the brief presented by the Canadian Federation of Mayors and Municipalities. The percentage of the population served in a province or region is, of course, affected by the proportion of urban to rural population. Where urban dwellers predominate, as in the case of British Columbia, the percentage served is likely to be high. Where large numbers live in rural areas, as in Saskatchewan, the percentage served is likely to be lower.

British Columbia has 151 water systems serving 887,000 persons or 76% of the total population. The larger centres, such as the metropolitan areas of Vancouver and Victoria, have abundant sources of good water comparatively close at hand and well protected for the future. These areas, as well as the Nanaimo area, are served by water district organizations, which, in effect, prepare the product and sell the water wholesale to the constituent municipal members, each of which operates its own distribution system. The Greater Vancouver Water District was incorporated in 1924 and now serves 14 municipalities and some unorganized areas. The Greater Victoria Water District was established in 1948 and the Greater Nanaimo District in 1953. The operations of these districts have been successful. The combined strength thus obtained has made possible the adoption of projects and forward-looking policies that would have been difficult, if not unfeasible, for the individual municipalities.

Rivers, creeks and lakes are the main sources of present water supply in other urban areas with some dependence on springs and wells. Since many municipalities and areas with comparatively small populations are now served, the backlog of capital requirements does not appear large.

The provincial brief estimated capital expenditures of water boards, including those of Greater Vancouver, Victoria and Nanaimo, at $39.6 million for the period 1955-75, and forecast a population increase for the province from 1.3 million in 1955 to a minimum of 2.3 million and a maximum of 3.0 million. The Greater Vancouver Water District, although its present capacity is adequate for a larger population than it now serves, expects to spend from $30 to $35 million in the next 25 years, and the Greater Victoria Water District may need $14 million in the same period. These estimates do not include expenditure for laterals in the local distribution systems, the cost of which might be about $60 million. If to these figures is added the capital expenditure required to serve the increased population in other urban areas plus a portion of the population falling into the rural non-farm category, and if some provision is made for replacement, total capital requirements come to about $175 million.

Alberta has 132 water works systems supplying 471,000 persons or 50.2% of the population. The cities, most of the towns and many of the villages have water systems, quite a number of which have been installed within the last four years. Calgary and Edmonton, among other cities, obtain their supplies from rivers; and while, with the work now projected in Calgary, these sources at present appear adequate, it is possible, if industrial growth continues, that some reservoirs to regulate flow may be required in these and other rivers within the 25-year period.

No forecasts of capital requirements for waterworks were given in the provincial brief. Edmonton's capital expenditures on this service amounted to $13.4 million in the period 1946-55 inclusive, and a further expenditure of $35 million is expected by 1980 on the assumption that the city's population will have reached 400,000 by then. Calgary expended $11.5 million on its waterworks system in the 1946-55 period and expects to spend at an annual rate of $2 million for the next five or ten years. If Edmonton's estimate is accepted for a population increase of 175,000 and if requirements for the rest of the increase in urban population are estimated at $150 per capita with some provision for replacement, the total for the province comes to about $125 million.

Saskatchewan has 45 waterworks systems supplying 260,000 people or 31.2% of the population. Regina has recently expended about $7 million to provide an assured supply of water from what is known as the Buffalo Pound Lake Reservoir, which is situated some 35 miles northwest of the city. Future requirements, largely for servicing new areas, on the assumption of a population increase to 125,000, and for replacement and reconditioning, were estimated at about $6 million for the period 1956-81. On the assumption of a population increase to 100,000, Saskatoon which secures its supply from the South Saskatchewan River, estimated capital expenditures for the period 1956-81 at about $8 million. Moose Jaw par-

ticipated in the Buffalo Pound project and the city's brief expressed the belief that this ensured an adequate water supply for 50 years. In June, 1956, however, it was reported that additional filtration facilities were required, the cost of which would be about $175,000 to Moose Jaw and $525,000 to Regina.

The provincial brief gave estimates of municipal capital expenditures for installation of waterworks and/or sewage systems and for enlargement or improvement of existing systems. The figures covered the period 1956-60 and were as follows: towns and villages, $9 million (entire period); cities, $2.25 million annually.

Accepting the estimates of Regina and Saskatoon for the population increases mentioned, calculating the requirements of the remainder of the estimated increase in urban population at $150 per capita and adding $5 million to cover some 40 small communities, each with a population of 500 or more but at present without waterworks, one reaches a total figure of about $62 million.

Manitoba has 28 waterworks systems supplying 430,000 persons or 55.4% of the total population. The Greater Winnipeg Water District, incorporated in 1913, delivered its first supplies in March 1919 and now serves nine municipalities, each of which has its own distribution system. This great enterprise has been of inestimable value to the community it serves. Water is brought from Shoal Lake, the western arm of Lake of the Woods, by gravity through a covered concrete aqueduct 84.5 miles in length and thence under pressure through a concrete pipe to city reservoirs. The total length is 96.5 miles. The basic system is deemed adequate to serve 850,000 people. For the period 1955-80 capital expenditures by the district were forecast at $44 million, of which $36 million would be for the period 1975-80. For the constituent municipalities, expenditures will be $28 million. About $5 million will be needed to meet an existing backlog in towns and other areas. If to this is added the cost of supplying increased population in other areas at $150 per capita, total estimated requirements become about $100 million.

Ontario has 399 waterworks systems supplying 3,400,000 persons or 74.1% of the population. There are 160 municipalities which require new systems of supply and distribution and assured supplies of acceptable water. The Municipality of Metropolitan Toronto, now having an aggregate population of more than 1,300,000 persons in its 13 individual municipalities, is responsible for the construction and operation of both pumping and treatment plants and trunk mains in its area. Local distribution systems continue to be built and operated by the local authorities. The main source of supply is Lake Ontario, but much new housing and industrial development is occurring at a considerable distance from the source. The Metropolitan Toronto brief estimated waterworks expenditures for a 25-year period at $155 million.

exclusive of developers' costs. The City of Hamilton's programme for the period 1955-60 amounts to more than $7 million. Ottawa's forecast total for a 25-year period is $35 million.

The provincial brief estimates capital expenditure on municipal waterworks in the next 20 years at $1,100 million. This includes water distribution systems, purification plants and supply works of all kinds. It is for new systems, for extensions and rehabilitation of old ones and for bringing water supplies from distant points to the local distribution systems. The brief describes the position of municipalities in the southwestern area of the province and includes in its estimate an amount of $400 million to cover pipelines from the Great Lakes to service the area. Legislation was enacted at the 1956 session to establish the Ontario Water Resources Commission among whose functions would be to give effect to the plan to supply inland places. Since this commission has now commenced operations, the item of $400 million has been included in our estimates.

If to the Municipality of Metropolitan Toronto's estimated requirements of $155 million there is added $35 million for estimated developers' expenditures in that area, and if capital requirements in other urban areas are calculated at $150 per capita to cover (a) the increase in population during the period, (b) the population in the 160 municipalities mentioned in the provincial brief as requiring services, and (c) an estimated one-third of the population in smaller places (rural non-farm), and if $50 million is included for replacement, estimated capital requirements come to $780 million. The $400 million for feeder pipe lines, pumping installations, irrigation feed lines etc. is additional to this.

Quebec has 725 water systems serving 3,010,000 persons or 74.4% of the population. Metropolitan Montreal has a plentiful supply of water close at hand in the St. Lawrence River. For Montreal City alone it was estimated that expenditure for major waterworks plants in the next 25 years would amount to more than $50 million. This would include a new filtration plant. Quebec City estimated its capital requirements at $13 million for the 1955-80 period.

All cities and nearly all town corporations in the province have waterworks systems supplied from rivers, lakes, springs and artesian wells. (The province is fortunate in having many fast-flowing rivers and numerous lakes.) At the close of 1952 there were municipally-owned waterworks systems in 155 villages, 45 parishes, 11 townships and 38 other settlements. In addition the Administration of Public Services sets at 605 the number of public waterworks systems operating in the province which belong to individual companies or associations. These include a great number of small waterworks systems, serving only a few persons, which are, or much resemble, family concerns. There are, however, a number which serve whole villages or

municipalities or large parts of them. The 158 localities served by privately-owned waterworks of some importance include 52 in villages, 77 in parishes, eight in townships and 21 in other areas.

The installation of municipally-owned systems is likely to increase in the years ahead, stimulated in part by an act passed by the Legislative Assembly in December, 1955. Under this Act the Lieutenant-Governor in Council may authorize the payment to any municipal corporation of up to 3% of the interest on any loan which it raises for the establishment or improvement of a waterworks system. The aid is limited to municipalities which did not exceed 7,000 in population at the last census.

If to the estimated $50 million programme of major capital works in Montreal an amount calculated at $150 per capita is added for the estimated increase in population in the Greater Montreal area, plus a further amount calculated at $150 per capita for the estimated population increase in other urban areas, plus an amount similarly calculated to cover the servicing of one-third of the population in smaller places (rural non-farm), plus $75 million for catching up and replacement, total capital requirements become about $675 million.

The ***Atlantic Region*** has 97 waterworks systems serving 638,000 people. Of these, New Brunswick has 26 systems serving 187,000 or 36.2% of the population, Nova Scotia 48 systems serving 320,000 or 50.2%, Prince Edward Island two systems serving 26,000 or 26.4%, and Newfoundland 21 systems serving 105,000 or 29% of the population. Most of the towns in New Brunswick and Nova Scotia have water systems.

The New Brunswick brief forecast a $35.8 million capital expenditure for water and sewer services in the next 25 years. Nova Scotia's estimate of capital requirements for water and sewer services, based on the average capital expenditures of the past five years, was $28.5 million. This does not take into account the probable growth in population. The general manager of the Public Service Commission of Halifax said in 1955 that it would cost $8 to $10 million to care for suburban areas not then supplied with water or sewer systems, and a further $10 to $15 million to service new developments during the catching-up programme. In the Newfoundland brief it was estimated that total investment in water and sewerage systems over the next 25 years would be about $1 million annually. This was based on the assumption that 15 urban centres would install waterworks at $135 per capita for a total of $4.5 million; that $2 million would be spent on existing systems; and that three-quarters of the estimated increase in urban population, from 168,000 in 1951 to 400,000 in 1980, would be serviced at a cost of $17 million ($100 per capita), making in all $23.5 million.

If the capital expenditure required to meet the needs of the expected increase in population to be served in the 25-year period is calculated at $125

per capita—and this seems reasonable on the basis of the above information—and if a further $5 million is added for replacement, the total for the region comes to about $90 million.

In the *Yukon Territory* and the *Northwest Territories* capital expenditure on waterworks services in the 25-year period is estimated at $8 million. Work now under way at Whitehorse in the Yukon and at the new townsite of Aklavik in the Northwest Territories will require about $2.5 million. Fort Smith may need $1 million. Future mining developments in areas such as Pine Point on the south shore of Great Slave Lake and in areas in the Yukon will no doubt result in settlements needing waterworks, and $4.5 million has been included on this account.

Estimated Capital Expenditure by Periods

Water is of such vital importance that municipalities with growth potential must of necessity be forward-looking in providing an adequate supply. Wartime restrictions, however, retarded works that would otherwise have been proceeded with, and the unprecedented growth in population and the industrial expansion in some areas have made it difficult to catch up with demand. It is likely, therefore, that capital expenditure for waterworks in the 10-year period 1956-65 will be greater than one would expect on the basis of the anticipated increase in population. Allowance has been made for this in Table 47.

Table 47

ESTIMATED CAPITAL EXPENDITURE ON WATERWORKS, BY PERIODS

Period	Millions of 1955 dollars
1956-65	975
1966-70	435
1971-75	480
1976-80	517
Total	2,407

8

SEWERAGE REQUIREMENTS

IF WATER is essential for the existence of urban communities, sewerage works are equally necessary to maintain sanitation and to protect public health. This need grows more intense as an ever larger percentage of population concentrates in urban areas.

Canadians have been somewhat slow in supplying themselves with adequate sanitary facilities. We have tended to retain the practices of earlier times when sewage could be discharged into a sizable stream or body of water with dilution providing natural purification. This is indicated by the fact that while there are 1,577 waterworks systems in the country, there are but 845 sewer systems; and only 445 sewage treatment plants, 288 of which provide only partial treatment. Quite frequently these systems serve only limited sections of the municipalities involved.

Sewerage needs have been increased by the industrial development that has taken place. It is a problem for public officials to decide whether industrial wastes should be allowed to enter the sewers or whether such wastes should be treated at the plant responsible for them. If the industry undertakes to treat its own wastes, it must meet the same standards as those of the municipality. Many wastes require preliminary treatment before being discharged into the public sewers. Our estimate of capital requirements does not include the cost of special installations for industrial wastes which are difficult to handle. It is assumed that such costs will be borne by the industries concerned.

The degree of treatment of sewage must be fixed by local needs, and its determination is generally assigned to the provincial department of health. Primary or partial treatment can be used if dilution of the effluent is high. Only about 60% of the solids and 35% of the organic material will be removed by this method. In complete or secondary treatment, biological processes are put to work to effect a removal of 90% to 95% of solids and organic substances. Future needs will be influenced by the degree of treatment required

in each place. As population concentration increases, more extensive treatment will be needed and the cost will rise considerably.

The objective should be to provide adequate services to urban areas, including the smaller ones, and to ensure that works will be built to provide treatment for all sewage and industrial wastes where these cause harmful pollution. The need for disposal works in some of our large and in many of our smaller cities and towns is already urgent.

Our estimate is that $2.7 billion will be required for this purpose in the next 25 years. This will provide for the construction of lateral sewers, trunk lines, sewage purification works and outfall sewers. It will involve new systems and extensions and modifications of existing systems. The division of this cost by province or region is shown in Table 48. The notes which follow give some regional information obtained from briefs and other sources, and attempt to explain the basis of the estimates. Figures of the number of sewer systems and the population served are from the brief submitted by the Canadian Federation of Mayors and Municipalities.

Table 48

ESTIMATED CAPITAL REQUIREMENTS FOR SEWERAGE SYSTEMS, 1955-80

(1)	(2)	(3) Estimated capital requirements	(4)
Province or region	Estimated increase in population served (thousands)	In millions of 1955 dollars	In dollars per capita based on col. 2
British Columbia	1,356	240	$177
Alberta	811	165	203
Saskatchewan	411	85	207
Manitoba	466	75	161
Ontario	4,322	1,070	246
Quebec	4,249	950	224
Atlantic	667	85	127
Total	12,282	2,670	217

Regional Notes

British Columbia has 46 sewer systems serving 655,000 persons or 56.3% of the population, but 232,000 persons served by waterworks are without sewer systems and a considerable number of these reside in the Greater Vancouver and Greater Victoria areas. A report prepared by a board of engineers and presented in 1953 to the Vancouver and Districts Joint Sewerage and Drainage Board described some of the conditions in the Greater Vancouver area as follows:

> "To date no treatment of any kind has been given to the sewage in the Greater Vancouver area, and crude sewage has been discharged at an increasingly large number of outfalls into the environmental waters, both salt and fresh. The result has been that some of these waters and their shores have become polluted to an extent that is definitely disagreeable, if not actually dangerous to health. . . . Large portions of the area are covered with relatively impermeable surface materials. Individual septic tanks and cesspools to serve the homes and businesses in such districts sooner or later become unsatisfactory, unhygienic and sources of public nuisance. For that reason public sewerage becomes imperative. . . ."

These comments are included here, not to place undue emphasis upon conditions in this area, but rather because similar conditions exist in many parts of other provinces and regions.

The Vancouver and Districts Joint Sewage and Drainage Board, as created in 1914, included in its jurisdiction the present Vancouver City area, Burnaby and the Glenbrook drainage area of New Westminster. It was empowered to construct, operate and maintain main sewers and works within the area, but the constituent municipalities retained responsibility for laterals and local works. Recently the Legislature replaced the 1914 board by a Greater Vancouver Sewerage and Drainage District Board, which includes Vancouver City, Burnaby District and the University Endowment Lands. This, of course, covers only a part of the present Vancouver Metropolitan area; however, other municipalities may join if they wish.

The provincial brief forecast capital expenditure of $139 million by the Greater Vancouver and District and Greater Victoria and District Sewerage and Drainage Boards in the period 1955-75. It was estimated that an additional $100 million might be required for local sewers and sanitary works. The board of engineers which reported to the Vancouver District estimated that about $65 million would be required to meet immediate needs for sewage disposal works in the Greater Vancouver area, including the North Shore. Victoria City pointed out that its sewerage and drainage systems were constructed principally between 1895 and 1915 and that many of the outfalls now needed to be redesigned. Expenditure for this purpose and for replacement was estimated at about $4 million. This was for the city alone and did not include suburban areas.

Urban areas near the seashore in the province have an advantage over inland places in that sewage effluent may be more readily and less expensively disposed of. Fast-flowing streams in some other parts of the province are also convenient for this purpose. Allowance was made for these factors in the unit costs used in our capital requirement estimate of $240 million, which was determined as follows: to the board of engineers' estimate

of $65 million, taken as representing the backlog of major sewerage works in the Greater Vancouver area, $23 million was added, being the estimate of Vancouver City for local requirements during the period. Local needs for an expected increase of a further half million in population in other sections of Metropolitan Vancouver, calculated at $125 per capita, amounted to $63 million, while requirements for increased population in other urban areas, calculated at $150 per capita, came to about $54 million. An amount of $35 million was added for the 232,000 persons now with water service but no sewers.

Alberta has 122 sewer systems serving 464,000 persons or 49.4% of the population, only 7,000 fewer than are served by its waterworks systems. Edmonton estimates its capital requirements at about $55 million for the next 25 years on the basis of a population increase of 190,000. In the period 1946-55 its capital expenditures on storm and sanitary sewers were $25 million, while Calgary's capital expenditures over the same period for this purpose were about $12 million. Calgary plans to spend about $3 million annually on this account over the next few years.

Sewage disposal is likely to be more costly on the average in Alberta than in British Columbia. If capital requirements for Edmonton are estimated at $55 million for a population increase of 190,000, and if requirements for the rest of the expected increase in urban population are calculated at $175 per capita, a total figure of $165 million is obtained.

Saskatchewan has 35 systems serving 245,000 persons, or 29.5% of the population, only 15,000 fewer than are served by waterworks. The last figure, however, does not give a complete picture of accumulated needs, since, as has been mentioned, there are about 40 places which should be supplied with waterworks, and many, if not all, of them will presumably need sewerage facilities as well. Regina calculated that about $21 million would meet its needs for an expected population increase of 42,000, and Saskatoon estimated $9 million for an expected population increase of 35,000. Saskatoon, with the South Saskatchewan River flowing through it, may find the need for a disposal plant less pressing. If $175 per capita is applied to the remainder of the estimated urban population increase, total requirements come to about $85 million.

Manitoba has 26 systems serving 405,000 persons or 52.1% of the population—25,000 fewer than are served by waterworks systems. As in the case of Saskatchewan, this does not tell the whole story since there are more than 20,000 persons in other urban areas needing both waterworks and sewer systems. Also a few of the larger towns are likely to require treatment facilities in the near future.

The Greater Winnipeg Sanitary District was incorporated in 1935 for the purpose of constructing and operating a sewage disposal plant to serve the

City of Winnipeg and certain adjacent municipalities. Since the beginning of 1938, the district has operated these works, which now serve Winnipeg, St. Boniface, East Kildonan, West Kildonan, St. Vital, Transcona, St. James, Fort Garry and Tuxedo, the latter three having joined the district on January 1, 1955. Each municipality recovers its share of the annual operating and maintenance costs, together with the annual debt charges on its portion of the capital cost, by means of a sewer rental charge. In the City of Winnipeg's brief the capital expenditures of the Greater Winnipeg Sanitary District for the next 25 years are estimated at $11.3 million, and those of the municipalities in the area at $23.7 million—a total of $35 million for an expected population increase of 250,000. Calculating the requirements for the remainder of the expected increase in population to be served at $175 per capita and including $8 million for backlog brings the grand total for the province to about $75 million.

Ontario has 272 sewer systems serving 3,200,000 persons, or 69.1% of the population, compared with 3,400,000 served by waterworks systems. There are 160 places which do not have waterworks systems but which need them, and it may be presumed that these places will require sewerage systems also. The provincial brief states that 69 of the municipalities now operating sewer systems have no treatment plants and that many other municipalities need enlargement or reconstruction of existing plants. For the construction of sewage-treatment plants, as well as of trunk sewers leading to them, an expenditure of approximately $210 million is estimated to be necessary within the next five or ten years. This includes no provision for the normal extension of lateral sewers. The brief points out the problems arising from the fact that a number of its medium-sized but fast-growing cities and quite a number of its expanding towns are inland from the Great Lakes, thus necessitating a higher degree of treatment because comparatively small streams must be utilized as outlets. All these factors increase cost.

The brief notes that sewage and industrial-waste disposal is a more acute problem in Southern Ontario than in any other part of the province and that heavy capital expenditure will be needed in the near future. Total capital requirements for sewage works projects are estimated at $1,300 million for the next 20 years, with probably 60% to 65% of the amount being required in the next ten years. The total does not include special installations for industrial wastes which are difficult to handle. These, the brief says, should be dealt with by industry.

The Ontario Water Resources Commission is empowered to enter into agreements with municipalities on an area basis for installation of sewage disposal plants. Subject to Cabinet approval, the commission may borrow money for its purposes, and its securities may be guaranteed by the province. The commission will investigate projects, assume the cost of engineering surveys, build and operate the plants, except in cases where the municipality

desires otherwise, and charge an annual fee to cover all costs. Municipalities will be allowed to spread the cost of financing over 30 years. Heretofore, a 20-year financing basis has prevailed. Municipalities will continue to build and maintain their local collection systems. The establishment of the commission has stimulated general interest in the problem of water pollution, and already a number of municipalities are studying the possibility of utilizing its services.

In the brief of the Municipality of Metropolitan Toronto it was estimated that in the next 25 years the aggregate capital expenditures of the metropolitan corporation and the 13 area municipalities for sewers would be $215 million. This does not include developers' costs or expenditures in fringe areas. At the present time some 32,000 dwelling units in the metropolitan area are served by septic tanks, while of a total of 19 individual treatment plants, 12 are substantially overloaded. Drainage of surface waters is becoming a problem of increasing seriousness also. It was estimated in the brief that population in the 13 municipalities would increase in the next 25 years by about 1 million. In Hamilton, a report on a sewerage survey prepared by a firm of consulting engineers and presented in June, 1955, estimated the cost of a complete sewage treatment plant at $13.4 million. It was estimated that a further $4.3 million was needed to meet present requirements for main storm and sanitary sewers. Hamilton's present population is about 225,000.

It is here estimated that the province's total requirements over the 25-year period will reach $1,070 million. This includes: Metropolitan Toronto's estimate of $215 million, exclusive of developers' costs, for a population increase of one million persons; $80 million for the cost of lateral sewers and connections; $565 million, calculated at $175 per capita, for the increase in urban population to be served in the rest of the province; and $210 million to cover the backlog for disposal plants and sewers leading to them. The figure of $1,070 million is less than the $1,300 million forecast in the provincial brief for a 20-year period. The latter amount was calculated by applying a per capita rate of $10 to an estimated average population of 6.6 million and multiplying the result by the number of years in the period covered.

Quebec has 258 sewer systems serving 2,100,000 persons or 51.9% of the population, but 910,000 persons served by waterworks are without sewer systems. The St. Lawrence and other large and fast-flowing streams have been heavily used for disposal, with the result that some have reached an alarming state of pollution. Dr. J. Prevost, professor of biology, University of Montreal, in a speech made in April, 1956, said:

> "There has been common belief that the very volume of our running waters enables them to take a little pollution in their stride, but nowadays we are dealing not with just a little pollution but with a vast, gigantic amount of pollution in some rivers."

He remarked that "the lovely waterways of the province have become veritable open sewers converging on the beautiful but filthy St. Lawrence".

In December, 1955, the Quebec Legislative Assembly gave unanimous approval to a bill setting up a 5-man committee to study water pollution problems across the province. The committee is to determine the extent, nature and causes of pollution and make recommendations to the Quebec Cabinet. It was noted during discussion of the bill that pollution of Lake St. Louis, near Montreal, and of the Ottawa river created very serious problems.

If it is assumed that sewerage service will be provided for the expected increase in urban population in the province in the 25-year period and for the population now having waterworks but no sewers, and that the average cost will be $175 per capita, requirements work out to about $750 million. Disposal plants will no doubt be required in the large metropolitan areas and in many smaller cities and towns, as few such plants exist in the province at present. Possibly $200 million would not be an excessive estimate for such plants inclusive of trunk lines and outfall sewers. This would bring total requirements to $950 million.

The *Atlantic Region* has 86 sewerage systems serving 590,000 people or 33.7% of the population, 48,000 fewer than are now served by waterworks systems. Major cities and most towns have systems, and while there are few disposal plants, this does not necessarily indicate a backlog, since many urban places have direct access to the sea. In some areas, however, population growth is already creating pollution problems.

The New Brunswick brief estimates capital requirements of about $36 million for sewerage and waterworks purposes over the 1955-80 period. In June, 1956, the Minister of Lands and Mines for New Brunswick announced the appointment of a Water Resources and Pollution Control Board for the province. Among the board's duties will be to conduct a survey of the major watersheds in the province and to determine the sources and the degree of pollution therein and the effects of such pollution on public health, fish and wild life, agriculture, recreation and electric power development. The board is to study and make recommendations on the methods which should be adopted to prevent, lessen or limit pollution of lakes, streams and tidal flats; to classify these waters according to their use and degree of pollution; and to make recommendations regarding their present and probable future use.

The Nova Scotia memorandum on social capital requirements estimates expenditure for sewer and water services at $28.5 million for the period 1955-80. This is based on average capital expenditures over the past five years and does not take into account population growth.

In Prince Edward Island it was thought that about $3 million would be needed for sewerage and water services in the next 25 years.

In the Newfoundland brief it was estimated that total investment in sewerage and waterworks systems would amount to $1 million annually.

Capital expenditure on a per capita basis is likely to be less in the Atlantic region than in most other parts of Canada, owing to the more general access to sea waters. If a factor of $125 per capita is applied to the estimated new population to be served, and if $10 million is added for catching-up purposes, total requirements for the 25-year period become about $85 million.

In the *Yukon Territory and the Northwest Territories* capital expenditures on sewerage works is estimated at $8 million in the 25-year period. As explained in the waterworks chapter, this will be needed for work in Whitehorse and the new townsite of Aklavik, in Fort Smith and in settlements arising from mining developments.

Estimated Capital Expenditures by Periods

If municipal capital undertakings were proceeded with on the basis of urgency of need alone, the greater part of the estimated $2.7 billion required for sewerage works would no doubt be undertaken in the next ten years. In the Ontario brief it was stated, for instance, that probably 60% to 65% of their estimated expenditure of $1.3 billion would be required in the next ten years. Past experience indicates, however, that it is easier to postpone works of this type than it is, for instance, to postpone capital expenditure for water service. An attempt at balancing these two tendencies has been made in the division below, in which 50% of the total has been allotted to the first ten years, while the balance has been allotted to the other periods in proportion to expected population growth.

Table 49

ESTIMATED CAPITAL EXPENDITURE ON SEWERAGE SYSTEMS, BY PERIODS

Period	Millions of 1955 dollars
1956-65	1,335
1966-70	400
1971-75	440
1976-80	495
Total	2,670

9

OTHER ELEMENTS OF SOCIAL CAPITAL

Airports

Future airport requirements will be influenced not only by the growth of air traffic, but by technological developments in aviation the nature of which is extremely difficult to foresee. Under the circumstances, an elaborate forecast does not seem justified.

In the fairly near future, much expenditure on airports is likely to be devoted to the lengthening and strengthening of runways for the accommodation of large jet airliners. Beyond that point, the crystal ball becomes very clouded. The development of aircraft capable of vertical take-off may eventually render the present-day kind of airport obsolete.

One prediction seems quite safe: that navigation aids and equipment for air-traffic control will become increasingly important and more elaborate. The more traffic grows and the air becomes crowded, the greater will be the need for the regulation of aircraft movement.

Most expenditure on civil airports in Canada is carried out by the federal government. A preliminary survey by federal officials suggests that over the period 1957-66 inclusive, expenditure on runways, ramps, lighting, roads and terminal buildings for civil aviation purposes may amount to about $207 million. A survey of requirements in the field of navigation aids and traffic-control equipment has not been completed, but it is believed that these items might add perhaps $40 million or $50 million to the total. If a new type of traffic-control system were to be evolved, based on automatic electronic computation and automatic radar scanning, expenditure on radio equipment could well be larger. Much will depend upon the rate of growth of air traffic and the speed with which new control procedures and equipment are developed.

If expenditure on civil airports and their related equipment were carried on throughout the 25-year forecast period at the average annual rate im-

plicit in the figures just given, the total outlay would run between $618 million and $643 million. It is likely, however, that air traffic will continue to grow substantially after 1966 and that progressively higher annual rates of expenditure will prove necessary.

No estimates are available with respect to military airport requirements, but considerable expenditure must be expected here as well.

Altogether, it is quite conceivable that gross new investment in airports over the next 25 years might amount to as much as $1 billion or $1.5 billion, with perhaps a quarter of the total accounted for by navigation aids and control equipment. If air travel grows as much as some of its more enthusiastic partisans predict, expenditure could possibly be a multiple of the amount mentioned .

Churches and Related Buildings

Church authorities, like many municipal authorities, have been almost overwhelmed by the urgent need for expanded facilities arising from the unparalleled urban growth and sprawl of recent years. In the ten years 1946 to 1955 inclusive, religious authorities invested about $270 million (current dollars) in the construction and equipment of hundreds[1] of new churches and other buildings used for religious purposes. Table 50 shows these expenditures on an annual basis for this period.

Table 50

CHURCHES AND RELATED BUILDINGS: NEW INVESTMENT IN BUILDINGS AND EQUIPMENT

	Current dollars	
Year	Total in millions	Dollars per capita
1946	6.2	0.50
1947	10.9	0.87
1948	23.6	1.84
1949	33.4	2.48
1950	32.5	2.37
1951	32.1	2.29
1952	27.0	1.87
1953	30.0	2.03
1954	35.5	2.34
1955	38.4	2.46

SOURCES: For 1946 to 1950 inclusive, *Private and Public Investment in Canada 1926-51*, Department of Trade and Commerce; 1951 to 1955 inclusive, *Construction in Canada*, (annual), Dominion Bureau of Statistics, and *Private and Public Investment in Canada; Outlook*, (annual), Department of Trade and Commerce.

At the beginning of 1956, the forecast of capital expenditure for this purpose during the year was some $49 million, or about $3 per capita, a considerable increase over the "preliminary actual" figure for the year 1955.

[1]Kerr, R. H. M., B.A., B.D., Extension Secretary, Presbytery of East Toronto. Presbyterian Church in Canada, "Church Extension in Community Planning", *Community Planning Review*, Vol. IV, 1954.

While there seems to be no definite and acceptable measure whereby the number of new churches and related structures required to meet the needs of the population in the next 25 years may be determined, some interesting ideas are set forth in articles in the *Community Planning Review*, Vol. IV. 1954. Rev. R. H. M. Kerr, B.A., B.D., Extension Secretary, Presbytery of East Toronto, Presbyterian Church in Canada, in his article, "Church Extension in Community Planning", says:

> "How large should a population in a new housing development be before a new church is established? Various answers might well be given on this question. Whether a community is large or small, its citizens need the services of a church. But in order that the venture may be economically sound and to prevent unnecessary overlapping, the criterion suggested by the "1953 Conference on Church Extension" in Philadelphia appears worthy of adoption, namely: on the average one church should be erected for 1500 to 2500 available population of Protestant preference."

Rev. Norbert Lacoste, Professor and Director of Sociology, Faculty of Social Science, University of Montreal, in his article, *"Urbanisme et Structure Réligieuse"* comments:

> "The parish must not be numerous. The ideal parish should not number over 5,000 individuals. The ideal figure would be from 3,000 to 4,000 persons in an urban parish, with two or three curates."

Rev. Dr. J. S. Thomson, Moderator of the United Church of Canada, Dean of Divinity and Professor of the Philosophy of Religion, McGill University, and former President of the University of Saskatchewan, says that it is significant in these times of economic expansion that one new church is being completed every five days.[2]

Even if it were possible to calculate with some accuracy the number of churches needed in the forecast period, selection of some unit of expenditure would be required in order to forecast capital investment. The wide range of structures involved makes this difficult. It seems advisable, therefore, to follow a different method and to relate the forecast to the rate of capital investment in recent years. Thus, if an expenditure of $2.50 per capita, about the same as in 1955, were accepted as a rate which would be maintained for the period, the forecast of capital investment would be about $1,350 million. If $3 per capita, the estimated figure for 1956, were chosen the total would be about $1,620 million. The forecast in Table 51 is a compromise between these two figures.

[2]Sermon at the dedication of the new St. Andrew's United Church at Ville St. Laurent, *Montreal Gazette*, Nov. 2, 1956.

Table 51

CHURCHES AND RELATED BUILDINGS ESTIMATED EXPENDITURE BY PERIODS

Period	Millions of 1955 dollars
1955-65	477
1966-70	280
1971-75	310
1976-80	418
Total	1,485

Other Government and Institutional Buildings

Governments and non-industrial institutions need a wide variety of buildings for purposes other than those already dealt with in this study. For instance all governments—federal, provincial and municipal—require legislative buildings. Post offices, postal terminals, customs and immigration buildings, armouries, barracks and drill halls are examples of structures for which the federal government is responsible. The responsibility for courthouses, registry offices, corrective institutions and other buildings needed for the administration of justice is shared by all levels of government. All governments, too, require office buildings, garages, workshops and warehouses. Governments may build museums, art galleries, libraries, concert halls and recreational facilities, or these may be provided by interested groups of citizens or by a combination of governments and private groups.

It is difficult to find a satisfactory measure for use in forecasting capital requirements for such buildings, and a special difficulty is the matter of timing. Examples are numerous of buildings for which the need is generally acknowledged, but construction of which is postponed year after year. City halls seem to be particularly subject to this treatment.

Some governmental briefs presented to the Royal Commission contained estimates for the class of structure under consideration here, but the coverage was not sufficiently wide or uniform to provide a base for Canada as a whole.

British Columbia estimated that in the period 1955-75 $13.3 million would be required for general government buildings, including 17 new buildings and 14 additions to existing structures, that $9.2 million would be needed for penal institutions and $4.5 million for boys' and girls' industrial schools, and that municipal requirements for public buildings other than schools would amount to $35 million. During this period the population of the province was expected to increase from 1,305,000 to a minimum of 2,277,600. The City of Vancouver estimated that in the period 1955-80, during which time its population was expected to increase from 375,000 to 550,000, some $13.3 million would be required for general public buildings,

$7 million for police and fire purposes and $1.8 million for libraries. The City of Victoria for the same period estimated its general building needs at $4.1 million, of hich $2 million ould be for a civic auditorium.

The Alberta brief, in its section covering the Department of Public Works, estimated that about $280 million would be required between 1955 and 1980 for construction of provincial public buildings,[3] with population expected to increase from 1,066,000 to 1,675,000 over the period. The brief contained the following comment:

> "It was possible to obtain close estimates of our construction needs during the next three years because the plans for the majority of the proposed buildings were already under discussion. For the years 1959 to 1964 the projection is based on an estimate of the cost of those buildings which we know we shall be required to construct in order to reach eventually a modern standard of accommodation for all departments of government."

A further comment was:

> "The normal expenditures of the Public Works Department do follow to some extent the population curve. Where variations are evident, such are caused by government policy or the non-availability of funds."

In the Saskatchewan brief it was estimated that from 1956-57 to 1960-61 general public building requirements would be $11.8 million, of which $6.5 million would be provincial and $5.3 million municipal. Homes for the aged would require $4 million, nursing homes $4.4 million and jails $0.6 million. Population is expected to increase by about 75,000 over the period.

Winnipeg expects to require $17 million for such items as a new city hall, fire halls, police stations and libraries in the next 25 years. During this time population within the present city limits is expected to rise from 255,000 to 300,000.

In the Province of Ontario's brief it was estimated that in the next decade $285 million would be required for mental hospitals and other provincial buildings. In the brief of Metropolitan Toronto it was estimated that needs of the metropolitan corporation and its 13 municipalities for municipal offices, courthouses, libraries, fire and police buildings and jails would amount to about $150 million in the next 25 years. In addition, old-age homes for 20,000 persons would be required. Ottawa expects to spend $8.3 million on various buildings including $3.5 million for a new city hall. A further $5.9 million will be needed for institutional homes. Hamilton expects

[3]Including offices, courthouses, jails, warehouses, highway maintenance shops, homes for the aged, auditoria, mental homes, provincial hospitals, schools of agriculture, the Institute of Technology, the School for the Deaf and the University of Alberta. Expenditure on some of these has, of course, already been forecast in this report.

to spend $4 million for a city hall and about $2 million for a courthouse and libraries in the next five years.

The City of Montreal estimated that a new city hall would require about $25 million, a concert hall about $4 million and restoration of existing buildings about $5 million. No estimate was given for miscellaneous buildings.

Table 52

EXPENDITURE FOR NEW CONSTRUCTION: OTHER BUILDINGS

(millions of dollars)

Type of building	1954	1955 (preliminary)	1956 (intentions)
Office buildings			
Federal	49.6	54.0	60.8
Provincial	10.3	16.1	18.9
Municipal	6.2	7.0	9.1
Institutions	1.1	0.3	0.3
Total	67.2	77.4	89.1
Factories, plants, workshops, food canneries			
Federal	26.9	30.7	33.2
Provincial	0.2	a	a
Municipal	1.3	4.3	6.7
Total	28.4	35.0	39.9
Warehouses, storehouses, refrigerated storage, etc.			
Federal	10.4	10.3	11.2
Provincial	2.0	3.9	4.6
Municipal	3.1	3.8	4.2
Total	15.5	18.0	20.0
Armouries, barracks, drill halls, etc.			
Federal	29.2	30.9	34.3
Garages and service stations			
Federal	2.6	2.7	3.0
Provincial	0.8	0.3	0.5
Municipal	2.7	2.7	3.0
Total	6.1	5.7	6.5
Theatres, arenas, amusement and recreational buildings			
Federal	0.5	0.7	0.7
Provincial	1.3	a	a
Municipal	4.6	2.6	3.8
Institutions	0.2	0.8	3.6
Total	6.6	4.1	8.1
Other institutional buildings			
Federal	16.3	17.6	19.8
Provincial	7.9	13.8	19.1
Municipal	4.6	4.2	5.9
Institutions	3.3	4.7	8.4
Total	32.1	40.3	53.2
Miscellaneous			
Federal	12.4	12.5	13.9
Provincial	3.6	1.5	2.1
Municipal	5.7	5.5	5.1
Institutions	2.8	2.5	0.4
Total	24.5	22.0	21.5

a Less than .1.

SOURCE: *Construction in Canada, 1954-56,* Dominion Bureau of Statistics.

New Brunswick estimated that about $2.4 million would be needed for miscellaneous provincial and municipal buildings in the 25-year period.

The Nova Scotia memorandum on social capital requirements estimated expenditures on provincial public buildings, excluding hospitals, at $17.5 million and on municipal buildings, excluding schools, at $6.7 million. The municipal estimate was based on annual average expenditure in the past five years. The effect of population growth was not taken into account.

In the Newfoundland brief it was stated that the present very inadequate facilities for housing provincial and municipal government departments would call for the erection of suitable public buildings and that, with municipal organization still in its early stages, there was a great deficiency of municipal buildings.

This recital, as suggested at the outset, provides a broad picture of the kinds of needs which exist in this field but does not establish a pattern or base for use in forecasting. Other avenues were explored, and of these the record of government expenditures given in the Dominion Bureau of Statistics publication *Construction in Canada* seemed to offer the best possibilities. While the series in its present form begins in 1951, this does not seriously limit its usefulness since economic conditions in prewar, war and immediate postwar years were much different from what is now looked upon as normal. Table 52, the components of which have been compiled from *Construction in Canada 1954-56,* shows expenditures for new construction of these buildings grouped (1) according to type and (2) by the agency making the expenditure.

Table 53 shows the expenditure of governments and non-industrial institutions on new construction of "other buildings" in the years 1951 to 1956 inclusive.

Table 53

EXPENDITURE FOR NEW CONSTRUCTION: BUILDINGS

Year	Population[c] (thousands)	Current dollars: Total expenditure (millions)[d]	Current dollars: Expenditure per capita	Constant dollars (1949=100): Total expenditure (millions)	Constant dollars (1949=100): Expenditure per capita
1951	14,009	178.4	$12.73	150.2	$10.72
1952	14,430	253.0	17.53	199.1	13.80
1953	14,781	207.4	14.03	156.4	10.58
1954	15,195	209.6	13.80	158.0	10.40
1955[a]	15,601	233.4	14.96	170.1	10.90
1956[b]	16,000	272.7	17.04	194.9	12.18
Average (6 years)			$15.02		$11.43

a Preliminary.
b Intentions.
c Dominion Bureau of Statistics estimates except for 1956, which is a guess.
d SOURCE: Dominion Bureau of Statistics, *Construction in Canada* (annual).

What level of expenditure may be expected in this field over the next 25 years? The constant dollar per capita figures in Table 53 do not show much variation except in the years 1952 and 1956. If the 1956 current dollar per capita figure of $17 is applied to the population forecast, capital requirements work out to about $8.9 billion. On the other hand, if $15 per capita, the average for the period 1951-56, is the factor used, total requirements come to about $7.9 billion. The figure chosen is, once again, a compromise. The distribution by periods in Table 54 is based on the assumption that outlays will follow the population curve.

Table 54

ESTIMATED EXPENDITURE BY PERIODS: OTHER BUILDINGS

Period	Millions of 1955 dollars
1956-65	2,836
1966-70	1,664
1971-75	1,844
1976-80	2,047
Total	8,391

Other Government and Institutional Construction

Governments undertake a variety of construction projects other than buildings. For example the federal government each year spends comparatively large sums on wharves, piers, docks, breakwaters and the dredging and improving of navigable waters. Provincial governments engage in irrigation and land reclamation projects. In the New Brunswick brief to the Royal Commission it was estimated that $8 million would be expended on dykes in the province in the period 1955-85, of which the provincial share would be $2 million. Municipal outlays cover such things as street lighting, traffic control, incinerators and garbage-disposal units. Expenditures on the latter

Table 55

EXPENDITURE FOR OTHER CONSTRUCTION

Year	Current dollars		Constant 1949 dollars	
	Total expenditure[c] (millions)	Expenditure per capita[d]	Total expenditure[c] (millions)	Expenditure per capita[d]
1951	49.0	$3.50	41.2	$2.94
1952	69.8	4.84	54.9	3.80
1953	107.8	7.29	81.3	5.50
1954	70.4	4.63	53.0	3.49
1955[a]	75.6	4.85	55.1	3.53
1956[b]	77.2	4.83	55.2	3.45
Average (6 years)		$4.99		$3.79

a Preliminary.
b Intentions.
c SOURCE: Dominion Bureau of Statistics, *Construction in Canada.*
d For population figures see Table 53.

two items are increasing, owing in part to the substitution of oil and gas furnaces for coal-burning furnaces and to the ever increasing practice of packaging food and other consumer products. Municipalities, too, face demands for recreation facilities — swimming pools, tennis courts, rinks, beaches, playgrounds and sports fields—while all levels of governments spend sums for park systems and facilities.

Table 55 shows the expenditure by governments on "other construction" for the years 1951 to 1956.

If it is assumed that the 1956 per capita rate of $4.82 (current dollars) is likely to be maintained for the next 25 years, the expenditure by periods of years and in total works out as follows:

Table 56

ESTIMATED EXPENDITURE FOR OTHER CONSTRUCTION

Period	Millions of 1955 dollars
1956-65	851
1966-70	499
1971-75	553
1976-80	614
Total	2,517

Government Departments: New Investment in Machinery and Equipment

Governments, like industries and private businesses, need many types of machinery and equipment to carry on their operations. For example, the federal government requires dredges, scows, tugs, scientific vessels, ice-breakers, and laboratory and scientific equipment. Municipalities require equipment for fire-fighting, police protection, snow-clearing, street sweeping and cleaning, refuse collection, traffic control and the like. Governments

Table 57

GOVERNMENT DEPARTMENTS' NEW INVESTMENT IN MACHINERY AND EQUIPMENT

Year	Current dollars		Constant 1949 dollars	
	Total expenditure[c] (millions)	Expenditure per capita[d]	Total expenditure[c] (millions)	Expenditure per capita[d]
1951	60.1	$4.29	50.8	$3.63
1952	88.2	6.11	74.9	5.19
1953	86.8	5.87	72.2	4.88
1954	76.3	5.02	62.9	4.14
1955[a]	67.8	4.35	54.7	3.51
1956[b]	68.5	4.28	54.2	3.39
Average (6 years)		$4.99		$4.12

a Preliminary.

b Beginning of the year estimates.

c SOURCE: *Private and Public Investment in Canada: Outlook* (annual), Department of Trade and Commerce.

d For population figures see Table 53.

at all levels use large numbers of motor vehicles of varied types, and government offices need an ever growing array of recording and calculating machines to speed up operations.

Table 57 shows the new investment of government departments in machinery and equipment for the years 1951 to 1956 inclusive.

If it is assumed that the per capita expenditure in current dollars for the year 1956 is likely to be maintained for the next quarter century, the expenditure for this purpose by periods of years and in total comes out as follows:

Table 58

ESTIMATED NEW INVESTMENT IN MACHINERY AND EQUIPMENT

Period	Millions of 1955 dollars
1956-65	762
1966-70	447
1971-75	496
1976-80	550
Total	2,255

10

CONCLUSION

IT REMAINS to summarize the forecasts of the study, and to make one or two general observations about them.

Table 59

FORECAST OF HOUSING AND SOCIAL CAPITAL EXPENDITURE, 1956-80

1. *In billions of 1955 dollars, by items*	
Housing	43.7
Social capital:	
Hospitals	2.7
Schools and universities	4.2
Roads and streets	19.5
Waterworks	2.4
Sewerage systems	2.7
Airports	1.3
Churches and other religious buildings	1.5
Other buildings	8.4
Other construction	2.5
Other machinery and equipment	2.3
Sub-total: Social capital	47.5
Grand total: Housing and social capital	91.2
2. *In billions of 1949 dollars*	
Housing	33.2
Social capital	34.5
Total	67.7

It should be emphasized that these amounts relate to capital spending only and do not purport to be predictions of total expenditure, both current and capital. In some fields of public expenditure, such as roads and streets, capital expenditure normally accounts for more than half of total expenditure. In others, such as education, the current element (staff salaries, operating costs, administration expenses, etc.) is in most years larger than the capital. It would thus be quite wrong to draw from the foregoing table the conclusion that over the next 25 years Canada is likely to spend, *in total,* nearly five times as much on roads as on education.

Once again, the reader should be reminded that the aggregate forecast is to be interpreted with the greatest caution and reserve. It shares with other Royal Commission forecasts the assumptions that there will be no global war, no economic depression on the scale of the '30's and no major change in government policies bearing on economic development. It is based largely on a prediction of population growth which may or may not prove accurate.

On the whole, it is probably a conservative forecast, if only because the allowance for replacement is incomplete and because the standard of facilities provided may rise in many fields. Some of the unit costs employed for estimating purposes may well be too low even by 1955 standards. Certain elements of cost may have been omitted inadvertently. One cost which has been deliberately left out is that of land. This, of course, can amount to a substantial figure for some types of capital project.

Considered in relation to what has been spent on housing and social capital in the past, the grand total of $91.2 billion may seem a large amount. Viewed against a background of prospective economic expansion, it is perhaps less startling. By 1980, Gross National Product and Gross National Expenditure may be in the neighbourhood of $76 billion.[1] By the same date, according to the present forecast, expenditure on housing and social capital may be running at annual rates of about $2.4 billion and $2.6 billion, respectively—i.e., may be accounting for about 3.2% and 3.4%, respectively, of Gross National Expenditure.[2] These are both rather lower proportions than those which have prevailed during most of the postwar period.[3] In 1955, housing and social capital expenditure together accounted for well over 10% of G.N.P.

The allocation of the forecast to five- and 10-year sub-periods largely reflects an assumption that needs will be met as they arise, neither sooner nor later. Such deviation as there is from this pattern is attributable to the allowance for certain backlogs, some of which are assumed to be made up fairly rapidly, others less rapidly.

In practice, the timing of future housing and social capital investment will no doubt be influenced by a host of economic factors not dealt with here, and by government policies. The question may be asked whether this large

[1]This is based on the assumption of an annual immigration of 75,000 and the average of the two productivity assumptions. See *Output, Labour and Capital in the Canadian Economy*, a study prepared for the Royal Commission by Wm. C. Hood and Anthony Scott.

[2]The $2.4 billion and $2.6 billion are calculated by means of a freehand graph. Percentages for intervening years may be similarly calculated as follows:

As Percentage of Gross National Expenditure (See note 1 above)

	Housing	Social capital
1965	3.9%	4.3%
1970	3.6%	3.8%
1975	3.4%	3.5%

The figures may be interpreted to suggest that if the economy grows as expected, the provision of housing and social capital of a good 1955 standard may become progressively easier. But then the standard may rise.

[3]See Table 1.

block of prospective expenditure should not be enlisted in the cause of economic stabilization—whether its timing should not be so managed as to mitigate fluctuations in the general level of economic activity. The idea that governments should build up a "shelf" of useful capital projects during periods of prosperity for implementation during periods of slackness will be familiar to many.

Table 60

FORECAST OF HOUSING AND SOCIAL CAPITAL EXPENDITURE, 1956-80 BY PERIODS

(billions of 1955 dollars)

	Housing	Social capital	Total
1946-55 (actual)[a]	10.2	9.6	19.8
1956-65.....	14.0	16.2	30.2
1966-70.....	8.4	9.0	17.4
1971-75.....	10.0	10.3	20.3
1976-80.....	11.3	12.0	23.3
Total 1956-80.....	43.7	47.5	91.2

a Revalued into 1955 dollars. For sources, see Table 1.

This is not the place in which to embark on an extended discussion of economic stabilization. Such a discussion would have to take account not only of compensatory public investment, but of other weapons in the contra-cyclical armoury—notably taxation and monetary policies. Due consideration would have to be given to the fact that Canada is a federal state and that the responsibility for public investment is shared by three levels of government.

It does seem in order, however, to make some observations about the inherent amenability of social capital investment, in particular, to compensatory timing. Assuming that the necessary fiscal arrangements could be made, to what extent might this sort of expenditure be postponed or accelerated as a means of offsetting broad ups and downs in the economy as a whole?

The first thing that needs to be said is that many government capital projects, especially large and complex ones, take rather a long time to start. There are limits to the amount of planning and pre-engineering that can be done on an *as and when* basis. Following the decision to go ahead, a further period must elapse, during which appropriations are secured and men, machines and materials assembled. Once a project is under way, it may well be speeded up or slowed down as is thought desirable. But by and large, compensatory timing is probably not at its most effective when employed against very short-term fluctuations.

Furthermore, of the total investment in social capital being contemplated at any given time, a substantial proportion is likely to be fairly urgent. Even that which is less urgent cannot all be postponed indefinitely: prosperity and economic expansion can go on, as it were, too long; and a time comes when certain projects simply have to be implemented.

If postponing capital projects is not always as easy as it sounds, neither is anticipating them. In a period of slackness it might be thought desirable to look ahead—to the prospective increase in school enrolment, for example —and to build more capacity than was immediately required.[4] But could one be sure that the right amount of additional capacity was being built in the right places?—that the future course of urban residential expansion was being correctly foreseen?

These objections, however, would seem to apply more to some kinds of project than to others. Within the categories of roads and government buildings, in particular, there should exist some good possibilities for compensatory timing. Expenditure in these two fields is already large and will grow larger. Relatively modest percentage variations in the total could have an important effect on the aggregate demand for goods and services.

Other opportunities for compensatory investment may come to light as the subject of urban renewal receives more widespread study. Here as elsewhere, there will be things which should probably be done right away (indeed, there are people who would consider this to be one of the most neglected of all fields of investment). But there may be other projects which, though useful, could be regarded as relatively "timeable". In a period of recession, an extra effort toward the rehabilitation and rebuilding of the older parts of cities might prove to be one of the most fruitful and revivifying of all forms of public expenditure.

[4]To a greater extent, that is, than was already the practice. See Chapter 5, footnote 32.

Appendix I

Table 61

HISTORICAL SUMMARY OF ENROLMENT IN PUBLICLY CONTROLLED DAY SCHOOLS,[a] 1926-50

(thousands of pupils)

School year ending June	Canada, excl. Newfoundland	Newfoundland
1926	2,085	52
1927	2,120	52
1928	2,154	58
1929	2,185	59
1930	2,220	61
1931	2,264	61
1932	2,286	59
1933	2,287	55
1934	2,216	55
1935	2,196	57
1936	2,189	59
1937	2,187	62
1938	2,190	64
1939	2,196	66
1940	2,165	67
1941	2,131	67
1942	2,088	66
1943	2,061	66
1944	2,061	63
1945	2,062	70
1946	2,106	70
1947	2,115	72
1948	2,151	73
1949	2,217	75
1950	2,300	78

a Includes enrolment in independent schools in the Province of Quebec, but not in other provinces. For this and other reasons, the figures do not agree exactly with those given in the text.

SOURCE: *Survey of Elementary and Secondary Education 1948-50,* Dominion Bureau of Statistics.

Table 62

DETAILS OF SECONDARY GRADE ENROLMENT IN THE PROVINCE OF QUEBEC, 1944-45 TO 1953-54

	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53	1953-54
1. Classical colleges										
(a) Affiliated[a]	8,016	8,212	8,354	8,392	8,729	9,078	9,500	9,742	11,119	12,536
(b) Not affiliated	1,871	2,125	1,199	1,973	2,015	2,019	1,986	2,027	2,000[b]	2,000[b]
2. Public schools	56,317	56,730	57,858	57,233	58,785	60,784	64,777	67,025	70,603	67,373
3. Independent schools	20,829	27,120	21,849	21,091	19,626	18,893	19,228	18,593	23,835	26,332
4. Modern secondary schools	1,169	1,094	1,111	1,097	1,183	1,182	1,278	1,280	1,300[b]	1,300[b]
5. Commercial schools	1,853	1,507	1,207	1,084	832	767	961	729	800[b]	800[b]
6. Vocational schools[c]										
(a) Technical	1,465	1,739	1,692	2,149	2,737	2,970	3,184	3,234	3,275[b]	3,300[b]
(b) Arts and crafts	2,162	2,802	3,270	3,070	3,009	3,869	3,840	4,116	4,200[b]	4,300[b]
(c) Agriculture										
Intermediate	418	483	459	504	500	530	494	458	500[b]	500[b]
Regional	426	432	427	307	318	339	306	273	275[b]	275[b]
Orphanages	779	973	1,382	1,215	1,506	1,447	1,370	1,373	1,400[b]	1,400[b]
(d) Household science	2,728	3,824	3,983	3,766	4,143	4,701	4,431	4,662	4,970	5,193
7. Total exclusive of agriculture orphanages	97,254	106,068	101,409	100,666	101,877	105,132	109,985	112,139	122,877	123,909
8. Enrolment in above classified as in private schools										
(a) Classical colleges										
Affiliated	8,016	8,212	8,354	8,392	8,729	9,078	9,500	9,742	11,119	12,536
Not affiliated	1,871	2,125	1,199	1,973	2,015	2,019	1,986	2,027	2,000	2,000
(b) Independent schools	20,829	27,120	21,849	21,091	19,626	18,893	19,228	18,593	23,835	26,332
(c) Modern secondary schools	1,169	1,094	1,111	1,097	1,183	1,182	1,278	1,280	1,300	1,300
(d) Commercial schools	1,853	1,507	1,207	1,084	832	767	961	729	800	800
Total private schools	33,738	40,058	33,720	33,637	32,385	31,939	32,953	32,371	39,054	42,968
9. Enrolment in public schools (7-8)	63,516	66,010	67,689	67,029	69,492	73,193	77,032	79,768	83,823	80,941

a Calculated at 65% of total enrolment.

b Estimate.

c Figures probably include some retarded students of secondary school age who in other provinces would be called pre-vocational students.

SOURCE: Dominion Bureau of Statistics, Education Division.

Appendix III

Table 63

SCHOOLS CLASSIFIED ACCORDING TO THE NUMBER OF ROOMS IN WHICH CLASSES WERE REGISTERED, IN 8 PROVINCES (QUEBEC AND ONTARIO EXCLUDED), 1953-54

(elementary and secondary schools)

Number of rooms	1	2	3	4	5	6	7	8	9	10-14	15-19	20-24	25-29	30 and over	Total schools
Province															
Nfld.	619	289	125	43	26	16	13	12	6	18	8	8	2	—	1,185
P.E.I.	361	61	9	2	4	2	3	4	1	2	2	2	—	1	454
N.S.	882	279	80	47	29	25	14	24	24	65	21	11	8	3	1,512
N.B.	1,001	178	44	47	29	28	12	18	25	56	27	8	7	4	1,484
Man.	1,315	126	93	57	31	32	26	33	16	63	30	18	9	4	1,853
Sask.	2,860	211	172	143	72	52	35	34	21	46	28	9	2	2	3,687
Alta.	973	163	84	101	70	47	43	52	37	114	57	22	6	4	1,773
B.C.	388	154	67	57	34	47	18	23	20	96	52	38	15	17	1,026
Total 8 provinces..	8,399	1,461	674	497	295	249	164	200	150	460	225	116	49	35	12,974

NOTE: In most provinces, all schools are not reported. The figures do, however, represent a large sample—more than 90 per cent, except for Manitoba and Alberta, where the percentage reported is 75-85.

SOURCE: Dominion Bureau of Statistics, Education Division.

Table 64

CLASS ENROLMENTS IN ONE-ROOM SCHOOLS IN RURAL AREAS AND CENTRES OF LESS THAN 1,000 POPULATION, (Quebec and Ontario Excluded), 1954-55

(elementary and secondary schools)

	Enrolment in class															
Provinces	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	Total classes	Median enrolment
Nfld.	—	21	60	93	91	90	94	71	38	14	4	—	—	—	576	26.3
P.E.I.	—	10	37	84	74	59	51	18	11	2	4	—	—	—	350	23.0
N.S.	3	101	157	210	187	134	79	43	17	8	1	—	—	—	940	20.0
N.B.	7	63	126	165	171	135	99	67	60	22	18	3	—	—	936	23.1
Man.	1	95	308	302	253	153	110	44	21	2	3	—	—	—	1,292	19.0
Sask.	8	303	694	636	404	189	91	31	9	4	1	—	—	—	2,370	16.4
Alta.	6	68	153	199	169	103	39	15	5	1	1	—	—	—	759	18.8
B.C.	1	35	100	79	53	42	17	7	1	1	—	—	—	—	336	17.0
Total 8 provinces	26	696	1,635	1,768	1,402	905	580	296	162	54	32	3	—	—	7,559	19.0

SOURCE: Dominion Bureau of Statistics, Education Division.

Appendix V

Table 65

TEACHING LOAD

REGISTERED CLASSES CLASSIFIED ACCORDING TO ENROLMENT

(Quebec and Ontario Excluded), 1954-55

(elementary and secondary schools)

	Enrolment in class														
Provinces	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80-89	Total classes	Median enrolment
Nfld.	—	24	74	183	288	327	428	425	381	237	159	39	11	3	2,579	34.6
P.E.I.	—	11	42	113	140	150	163	69	29	6	5	—	2	—	730	27.0
N.S.	6	113	211	375	552	685	891	897	528	226	74	9	1	—	4,568	31.9
N.B.	26	119	229	332	548	684	859	648	335	109	53	7	—	—	3,949	30.2
Man.	4	133	439	532	666	900	1,190	906	302	20	5	—	—	—	5,097	29.3
Sask.	11	332	860	1,061	1,171	1,193	1,119	663	201	60	14	—	—	—	6,685	20.3
Alta.	13	101	297	552	886	1,450	1,719	1,191	304	41	12	2	—	—	6,568	30.0
B.C.	5	70	206	308	532	1,046	2,006	1,858	617	48	1	—	—	—	6,777	33.0
Total number of classes, 8 provinces	65	903	2,358	3,456	4,783	6,435	8,375	6,657	2,777	747	323	57	14	3	36,953	30.3

SOURCE: Dominion Bureau of Statistics, Education Division.

MOVEMENTS IN ROAD CONSTRUCTION COSTS

THE CONCERN here is with changes in the cost of the combination of labour, materials and equipment services involved in road building, not with changes in road specifications and design standards. Both kinds of change have had the effect of increasing the average cost per mile of new roads since the '30's, but only the first is relevant when one is trying to eliminate the effect of price inflation on road construction costs.

The Bureau of Public Roads in the United States publishes a *Composite Mile Index* of price trends in highway construction, based on contract prices for federally aided construction. The composite mile is made up of average quantities of materials, and includes 17,491 cubic yards of excavation, 3,726 square yards of paving, 16,000 pounds of reinforcing steel, 4,325 pounds of structural steel, and 68 cubic yards of structural concrete. It does not represent quantities involved in the actual construction of any particular type of road. Bid prices and index figures for years subsequent to 1940 are adjusted downward in order to eliminate the effect of increased design requirements.

Comparison of this index with the Department of Commerce *Composite Construction Cost Index* would suggest that highway construction costs have not risen as much as construction costs in general. Thus, using the same periods employed in the text, it may be calculated that highway construction costs rose 102% between 1935-39 and 1951-54 but that general construction costs rose fully 140%.

Whether the two series really should be compared is a good question, since the general construction index is of quite a different character from the other. It is not an estimate of the cost of a constant "basket" of labour and materials; it is, rather, the equivalent of a variably weighted index, reflecting changes not only in the component indices, but also in the relative importance of the major classes of construction which are used as weights.

A further consideration is that the erratic pattern shown by the composite mile index arouses some doubts as to its validity. All the same, there would be some reason for expecting highway construction costs not to have risen as much as other construction costs. Highway construction has probably benefited more than other kinds of construction from cost-saving mechanical aids. The way roads are built has changed more since the '30's than the way buildings are put up—in Canada as in the United States.

In an effort to allow for this, the Canadian implicit price deflator in the table following has been multiplied by the United States highway index, then

divided by the United States composite construction index. This produces an index which bears the same relationship to the Canadian implicit price deflator as does the United States highway index to the United States composite construction index. It is this adjusted deflator which is used in column 2 and 4 of Table 35

Table 66

PRICE INDICES RELATING TO ROADS

(1949=100)

	U.S.		Canada	
	(1) Dept of Commerce composite construction cost index	(2) Bureau of Public Roads-Highways, composite mile index	(3) Implicit price deflator, non-residential construction	(4) (Col. 3 x col. 2 ÷ col. 1)
1935	45.2	55.3	53.9	65.9
1936	46.8	56.9	55.3	67.2
1937	49.9	54.4	59.7	65.1
1938	50.2	50.0	58.5	58.3
1939	49.5	49.8	57.8	58.2
1940	50.3	49.1	60.0	58.6
1941	53.4	55.8	63.3	66.1
1942	59.6	74.6	67.9	85.0
1943	62.8	85.6	70.9	96.6
1944	62.5	77.6	72.0	89.4
1945	64.8	74.8	72.3	83.5
1946	74.3	81.6	76.7	84.2
1947	90.6	92.7	85.4	87.4
1948	101.0	103.8	96.2	98.9
1949	100.0	100.0	100.0	100.0
1950	103.4	94.5	105.8	96.7
1951	112.0	105.5	118.8	111.9
1952	115.6	111.5	127.1	122.6
1953	118.2	109.9	132.6	123.3
1954	118.0	103.8	132.7	116.7
1955	121.3	104.8	137.2	118.5

SOURCES: (1) *Business Statistics—1955* (supplement to *Survey of Current Business*), U.S. Department of Commerce, Washington, 1955. Original base of index: 1947-49=100.

(2) *Highway Statistics—1954* (annual), Bureau of Public Roads, U.S. Department of Commerce, Washington. Original bases of index: 1925-29=100 and 1946=100.

(3) *National Accounts, Income and Expenditure* (annual), Dominion Bureau of Statistics, Ottawa.

THE COST OF NEW LOCAL URBAN STREETS

IN THE BRIEF presented to the Royal Commission by the Central Mortgage and Housing Corporation, the statement is made that in a new residential area provided with roads, schools, local shops and open space, there are unlikely to be more than 3.5 houses per acre of developed land.[1]

Certain calculations in the brief submitted by the Municipality of Metropolitan Toronto are based on a rather higher density of 4.5 housing units per acre, with 81.5% of the new units assumed to be detached houses, 10% semi-detached units, and 8.5% apartments. Again, allowance is made for shops, schools etc. Thus, of the 22.2 acres of land estimated to be required for each 100 new housing units, 14.6 acres are allocated to residential lots, 0.7 acres to commercial and other lots, 2.1 acres to "public purposes", and 4.8 acres to streets.[2]

The housing forecast in Chapter 3 indicates that some 3,700,000 new housing units may be built over the next 25 years. Of these, perhaps 100,000 will be farmhouses. Of the remaining 3,600,000, it may be presumed that a large majority will be built on newly developed land in expanding urban areas.

The problem here is to estimate what it may cost to provide such developments with local streets.

The cost per foot of a street of given specifications can vary greatly from locality to locality, depending on topography, soil structure, availability of materials, etc. Then, too, specifications themselves are anything but uniform across the country: different municipalities have different standards.

A fair amount of information concerning local street costs has been made available to the authors of this study by the Central Mortgage and Housing Corporation, city engineers and private developers. On the basis of these data, it has been concluded that the cost, in 1955 dollars, of providing a residential subdivision with an appropriate complement of paved streets, curbs and sidewalks may average somewhere in the neighbourhood of $2,800 an acre. This figure would apply where all streets were of a purely local-access character. In practice, a certain proportion of the streets in a typical subdivision are likely to be "collector roads"—wider, heavier, and more expensive than local access streets. To allow for these, the $2,800 is boosted to $3,000.

If it is assumed that 85% of the 3,600,000 new non-farm housing units will be built on land at present unprovided with streets and that on the

[1] *Housing and Urban Growth in Canada*, Chapter VII(1), brief presented by the Central Mortgage and Housing Corporation.

[2] *Brief of the Municipality of Metropolitan Toronto*, Chapter V, p. 63.

average an acre of land will be required for every four new housing units, the total cost of the necessary streets may be calculated as follows:

$$\frac{3{,}600{,}000 \times .85 \times \$3{,}000}{4} = \$2{,}295{,}000{,}000$$

New streets will also be required in new industrial districts. It is estimated that in the present Toronto metropolitan area and its surrounding fringe area, future industrial land requirements will be about a third as much as residential land requirements.[3] The ratio may not be as high in some other urban areas: perhaps 25% would be a reasonable allowance for Canada as a whole.

The cost of servicing an acre of typical industrial land does not, in general, seem to differ very much from the cost of servicing an acre of residential land in the same area. So far as streets are concerned, a smaller mileage may be needed, but it is likely to be more costly mileage.

To allow for street requirements in new industrial areas, therefore, the $2,295,000,000 estimate is simply increased by 25% to $2,868,750,000 or in rounder figures, $2,870,000,000.

It is doubtless highly unrealistic to assume that all new streets will be paved streets; on the other hand, no provision is being made for the paving of any existing streets. What is being assumed, in effect, is not that all local urban streets will be paved by 1980, but that a larger proportion of them will be paved.

[3] *Ibid.*, p. 57.

OTHER STUDIES TO BE PUBLISHED BY THE ROYAL COMMISSION

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[1]This is one of a series of three studies on Canadian international economic relations prepared under the direction of S. S. Reisman.

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